Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 65 NEW YORK, SATURDAY, FEBRUARY 13, 1915 No. 7

Co-operation That Is Not Combination

PRESIDENT WILSON'S promise to promote legalized approval of united action on foreign trade appears to rest on the discovery of "a method of co-operation which is not a method of combination." With all other industries, so long as co-operation on export business is not encouraged the electrical manufacturing industry is under an irremovable handicap in attempts to develop overseas commerce. When the Executive goes so far as to state that the problem is not to avoid doing the thing but to find a way of doing it that shall refrain from offending public sentiment, he steps forward with seven-league boots. What is really needed for permanent destruction of this insistent, vexatious obstacle is not only an administrative interpretation of policy that shall be permissive but a law to tell business men plainly that they can go ahead without danger of prosecution on civil or criminal charges. If a later President or Attorney-General should begin suits, and the indicted offenders claim only "co-operation," the courts will act independently if the arrangement proves to be a "combination" in any inhibited sense. If President Wilson will give sympathetic support to a definite movement to place our manufacturers on an equal footing with European manufacturers by permitting united action in whatever form may be made clearly legal, he will effectively further foreign trade.

Investigating Automobiles and Libraries

THUS far the New York legislative investigating committee has not brought out leading facts to show that the Public Service Commission, First District, is either effective or ineffective. To hear that rapid-transit facilities are inadequate does not startle New Yorkers. Daily experiences harden them to a point of view that up-State visitors do not understand. New York City could have had more facilities years ago, but it procrastinated. Now the agreed-upon improvements are being pushed earnestly. Until they are in operation it is difficult to increase service. By his own testimony the chairman of the commission has traveled in official automobiles to his Long Island country home and to baseball games. If no other public servant had ever done this, the selfish folly of it would be startling; but in common practice automobiles go with jobs. That the public has slight conception of the usual facts is shown by daily newspaper display of Judge McCall's jaunts. It has also been shown that the chairman gave time to private law practice. Probably the developments assure the political effect on the public that the investigators, who have a purpose, want to accomplish. If this were not so, they would not continue as they have been doing, nor would they talk about the "seven-thousand-dollar library of the commission which costs in salaries $5,000 a year." The value of the library rests in the classification and use of the fine collection of books, pamphlets and articles. If this helps the commissioners, it is necessary. Whatever the committee may do later, it is evident that in the first hearings only a partial case has been made.

Economy in New-Business Methods

NOTWITHSTANDING the industrial effects of the war, some large central-station companies in this country continued in 1914 to make a good showing. Combined operating revenues of the Edison Electric Illuminating Company of Brooklyn and the Kings County Electric Light & Power Company gained 10.5 per cent over 1913. The annual report indicates that the experience of these properties was the common lot of central stations in districts that did not suffer such undue depression as fell upon the South. Rate of growth was reduced, economies were introduced, and extraordinary efforts were made to get new business. Although expenses of the two companies named were so much higher as to absorb most of the increase in gross and the aggregate dividend payments were larger, the surplus was only a little below the previous year. The number of contracts signed increased 15.6 per cent, which is a conclusive demonstration of activity in new-business solicitation. The lesson which these figures offer is that the best economy for a growing business in a large community lies in redoubled energies for business to replace the load that drops away in times of business depression. This policy is not only more profitable immediately but it also means strengthened diversity of load for the future.

The Call of the West

OF the many reasons why a trip to the Pacific Coast next June will well repay those making it, the coming convention of the National Electric Light Association is only one. While that in itself were enough, there is the magnificent exposition on the shores of San Francisco Bay as an added incentive. More interesting than both, however, especially to the central-station manager and operator of the East, is the great West itself, with its men of vision, its pioneers of industry and progress, its great transmission systems and its inten-

sive loads. Instances of courage, stamina and grit abound in practically every community on the Pacific slope. There years ago engineers saw with eyes of faith the development of the great tracts lying between the mountains and the sea and extended long lines over desert lands to distant and infantile town sites little more than map-born. Events have justified the visions of the seers, and all along the coast and in the fertile valleys back of it electric arteries and veins course through cities, towns and villages as nowhere else in this country. California herself uses more electricity per capita than any other state in the Union, and her power systems have load-factors easily twice as large as those possessed by generating systems in the East. Her irrigation loads are immense, and there are few houses along the great stretch of coast line wherein the advantages of electricity are not known. These are the bare bones of fact; the pulsating, vital tissue must be seen, for the West is an inspiration that few can afford to miss. There the power of the melting snowflake on the Sierras has been utilized to the full to lift the load resting on human shoulders.

Progress in Synthetic Illumination

For some years the production of "fast" colors of the highest purity has been the objective of investigators in the field of synthetic illumination, and the realization of this desideratum, as outlined by Mr. M. R. Pervear before the New England Section of the Illuminating Engineering Society, is cause for genuine congratulation. A real advance seems to have been made over what has hitherto stood for the best practice in the production of color filters.

The work has involved long and arduous examinations of dyestuffs and other color-making chemicals in the search for primary color coatings which will withstand the heat of the lamp without peeling or fading during the life of the lamp, and which meet one final test of color purity through their complete opacity to light transmission when superimposed. By means of these colors innumerable blends and tints can be obtained by rheostatic variation of the lamp brilliancy, combined with the diluting effect of white light. It is becoming apparent that we are on the threshold of a world of luminous beauty comparable in some degree to the appeal of harmonious sounds to the ear, and the possibilities of appealing to the eye through synthetic illumination are worthy of serious study.

It would be idle to claim that finality has been attained in color synthesis, and yet enough has been done to indicate valuable new lines of development commercially on the basis of the tungsten lamp. Show-window lighting can be almost revolutionized by the use of properly designed color schemes in lamps and filters and of automatic rheostats and switching mechanism. It has long been realized by illuminating engineers that theater property men and electricians have made splendid use of rather crude material in the past, but now there are available possibilities of color-tone gradation and approximations of natural lighting conditions hitherto not readily attainable. Improvements in stage-lighting control are being developed to reduce the labor cost of lighting a performance artistically, and even the types of reflectors used in border and strip lighting are being overhauled in the interests of more even light distribution. Progress in the manufacture of artistic fixtures and filters is placing electric lighting on a new plane, and each new form of equipment introduces fresh possibilities of useful and stimulating service.

Panama-Pacific Exposition Illumination

We publish in this issue an illustrated article on the remarkable and unique lighting effects obtained at the Panama-Pacific International Exposition, to give it its somewhat long formal title, which will be officially opened on Feb. 20, 1915. The illumination of expositions is a branch of the art which stands to some extent alone. It resembles stage lighting more than any other, in that it is concerned with effects rather than with magnitudes, with harmony in intensity and color rather than with foot-candles. Following old Spanish precedents, which fortunately still linger on our Western coast, the buildings at San Francisco are distinctive in that free use has been made of color in both the architecture and the scheme of decoration. Just why color in architecture should have been somewhat under the ban it is difficult to understand. Saracen and Moor used it with effects which have been the wonder of the East, and of Europe wherever in the Dark Ages the Eastern civilization touched it with light. So the present exposition buildings are rich in color, and the lighting scheme has been planned to make the colors effective by night as well as by day.

Unquestionably the distinctive feature of the illumination of the Exposition is that the buildings are lighted and are not merely outlined or decorated with lamps. The major portion of the illumination is obtained from concealed sources, the purpose being to bring out by night the architectural features of the splendid structures that have been erected. Hence a very extensive use has been made of search-lanterns and reflector lamps of various kinds to flood the buildings with light in such a way as to give the utmost value to their decoration without dazzling the spectator by the blaze from the light sources themselves. Here and there where lamp standards possessed a distinctive decorative value they were used without hesitation, as, for example, in two fine illuminated columns which form the bases to great fountains.

Perhaps the most unusual and distinctive novelty in the illuminating effects is the Tower of Jewels. This main tower, 435 ft. high, is decorated with colored jewels of special glass cut in facets and so suspended as to tremble in the wind and thus give additional sparkle to the light reflected from them. There are more than 100,000 of these glittering points of color, which are illuminated at night by fifty 18-in. and four 30-in. search-lanterns placed on the roofs of various build-

ings and so hidden as to set the tower ablaze with light when they are put into service. Use is also made of a battery of forty-eight 36-in. search-lanterns fitted for color effects to play upon a screen of steam, forming a veritable aurora of light as a background to the Exposition proper and repeating with enhanced beauty the spectacular illumination so notable at the Hudson-Fulton celebration. Altogether the lighting of the Exposition is such as could have been produced only by close co-operation between a master of the art of illumination and architects and decorators inspired by real genius for form and color.

Power Records on Machine Tools

In a short article in the current issue are given some very valuable hints regarding the use of graphic wattmeters as indicators not only of the power consumption but also of the efficient use of motor-driven tools. The particular operation here studied was the turning to dimensions of the rough casting for a 12-in. projectile. A brief inspection of the data given will show that the power record marks out in the plainest possible manner any failure to utilize the tool to the best advantage. In principle the speed and feed should be so adjusted as to produce a steady load while taking off the metal at the best pace possible. If the power falls off, it is clear that the amount of cutting per minute might be increased and should be if the tool will withstand the treatment. Within this limitation the power chart taken from the tool gives much important information concerning the way in which that tool should be used, and also furnishes a complete record of the time in which the tool is not doing work. In other words, it shows all the time necessarily or unnecessarily taken off from the period of actual cutting. A little experience in the making and interpretation of such power charts should materially increase the output efficiency of the various motor-driven tools employed. The plan described is worth following out, for it seems both simple and effective.

Mercury Watt-Hour Meter

In the ordinary type of mercury-motor watt-hour meter a rotatable disk immersed in mercury serves as the moving element of the meter, and the line current, or a fixed proportion of it, passes through the disk. The mercury serves as a means of making contact between the disk and the external circuit, and also supports the weight of this disk and shaft, or at least a part of this weight. The field coils, which are connected across the line, set up a magnetic field in the disk at right angles to the direction of the current through the disk, and the reaction of this field on the current in the disk produces the rotation.

The watt-hour meter described by Mr. A. A. Radtke on page 395 of this issue is identical in principle with the ordinary type of mercury-motor watt-hour meter, the only difference being that in Mr. Radtke's type the current is caused to pass through the disk in a direction perpendicular to the plane of the disk and the magnetic field is parallel to this plane, whereas in the ordinary type the current is parallel to, and the field perpendicular to, the plane of the disk. The advantage, if any, gained by interchanging the directions of the current and field relative to the disk is not altogether apparent. Mr. Radtke's meter, like the ordinary mercury meter, can be used on alternating-current as well as on direct-current circuits, but, owing to the large cross-section of the current path, the "skin effect" in the disk will certainly be pronounced. This would tend to make the reading of the meter much more sensitive to changes in frequency than is the ordinary mercury type, and would, of course, make a direct-current calibration useless for alternating-current working. The ordinary mercury type as an alternating-current watt-hour meter leaves much to be desired, and it is not improbable that this new type would be still less satisfactory as an alternating-current instrument.

Filling Up the Load Curve

A note in the Digest contains some useful suggestions which may be of service to energy-transmission companies. The Prussian State Railway Department, operating a large electric railway, announces itself as anxious to furnish 30,000,000 kw-hr. per year to private consumers under certain specified regulations. The important feature is the schedule of prices arranged on the basis of off-hour use of the service. There are two proposed schedules, one of which permits the taking of energy at any time but with a 50 per cent increase in rate for energy consumed between 6.30 a. m. and 10 p. m. The rates are low enough in any case, 0.4 cent per kw-hr. for the night load and 0.6 cent for the day load, but the difference is enough to encourage the use of energy during the hours of low price. The consumer has to agree that he will take a certain minimum number of kilowatt-hours per year within a certain maximum power for which an automatic limiting device is applied. From the stated price a discount is then allowed depending not on the total energy consumed but on the ratio of consumption to maximum, encouraging thereby the utilization of the energy at the most favorable load-factor.

A second form of contract involves the sale of energy at certain hours, the no-load hours being specified in the agreements with separate consumers. This form enables the central station to take on loads at certain times when customers can be found who deem it practicable to agree to this limitation. The prices quoted in this case, however, are very low, so that the consumer has a considerable incentive to arrange his use of the energy, if possible, to fit the station requirements. Selling energy from railway transmission lines is, of course, not a novelty, the essential point of the present instance being the careful fitting of the rate schedule to insure the obtaining of an off-peak load which the station can well afford to carry at a low price.

LETTERS TO THE EDITOR

Weakness of Steel Towers

To the Editor of the ELECTRICAL WORLD:

SIR:—Referring to the letter by Mr. B. Haskell on "Weakness in Steel Towers" in your issue of Jan. 23, and assuming that the line in question, which we will call line A, is correctly identified by the writer, it should be noted that the greatest extent of failure was in flexible structures (A frames), and not in steel poles or steel towers. The writer understands that there was no failure in a steel pole (or semi-flexible structure), and that the failure of certain steel towers (or rigid structures) was due not to any inherent weakness in the general type of structure but to a possible lack of strength, or guys, for the unusual conditions of load encountered.

One hesitates to believe that an installation of this character was built of re-rolled material. Such grades of steel are, as Mr. Haskell assumes, prohibited in bridge and building specifications and in the various building codes. In addition to the irregularity in the strength of re-rolled material, such steel is very difficult to fabricate, and under the ordinary methods of fabrication in such work would be liable to injury.

The writer believes that in almost every instance in which steel transmission-line structures of the better classes have failed the trouble was due more to faulty design than to poor material or workmanship.

In the case of a line which we will call line B failure was due to the absence of adequate guys or stiffening structures, while in line C the weakness was confined to the corner supports. In both of these cases there were contributing causes, such as inadequate or temporarily weakened foundations, but the installation of a proper system of guys would unquestionably have rendered any of the above structures more nearly adequate to withstand its maximum loading.

R. D. COOMBS,
New York, N. Y. *Consulting Engineer.*

National Electrical Week

To the Editor of the ELECTRICAL WORLD:

SIR:—With reference to the proposed "electrical week" to be observed all over the country in October, 1915, please be advised that I think this is a splendid idea. I have discussed the matter with our sales manager, his assistants and a number of our staff, and I feel sure that the Dayton Power & Light Company in its whole district can be counted upon to co-operate strongly in this movement. It should result in a tremendous activity and impetus to the electric light and power business throughout the country. We shall be interested in noticing what progress is made looking toward carrying this matter to a successful conclusion, and shall plan for the early carrying out of the details necessary to make it a great success. F. M. TAIT,
Dayton, Ohio. *President the Dayton Power & Light Company.*

To the Editor of the ELECTRICAL WORLD:

SIR:—I read with much interest of the proposed "national electrical week" in your issue dated Jan. 30. About six months ago I wrote to Mr. Ell C. Bennett, who is in charge of the commercial division of the Jovian Order, St. Louis, to the National Electric Vehicle Association and to several others, suggesting that a movement be started to have "Jovian Day," Sept. 15 of each year, celebrated by all electrical interests, to be known preferably as "Electrical Day." Conversations with several newspaper men led me to believe that all newspapers in the United States would be glad to issue an electrical edition on that occasion, reviewing the progress and development during the past year. The edition would also naturally contain an unusual amount of electrical advertising. I further suggested that on that day an electric vehicle parade be held and the vehicle owners be induced to participate by prizes which would be awarded by the central stations, and that all of the firms engaged in the electrical business display appropriate pennants.

Whether it is decided to have an electrical day or an electrical week, I believe I can safely say that all electrical interests in Louisville are ready to co-operate in the movement and help to make it a great success.

ROBERT MONTGOMERY,
Louisville, Ky. *Manager Commercial Department Louisville Gas & Electric Company.*

To the Editor of the ELECTRICAL WORLD:

SIR:—The proposed "electrical week" movement should appeal to everyone in the electrical fraternity. The Jovian Order is a magnificent means of promoting it. I believe the co-operation of all the electrical workers can be enlisted toward a splendid success. The celebration of this week would soon become a yearly event looked forward to by all the "live ones" in the electrical line. The plan is most interesting and should prove highly successful. OSCAR C. TURNER,
Birmingham, Ala. *President Turner Electric Supply Company.*

Rural Meter Service

To the Editor of the ELECTRICAL WORLD:

SIR:—In connection with your article entitled "Meter Practice on Rural Electric-Service Lines" it may be of interest to note that for the past two years the Malone Light & Power Company has required the village customer to provide the necessary wiring so that the meters can be placed on the piazza, and the rural-line customer to provide wiring for installing the meter either on the piazza or in the barn. The registration of the meters has been found to be just as exact in these localities as when installed inside. The meters installed in the above-mentioned places are equipped with glass covers, although the thermometer often registers from 20 deg. to 40 deg. below zero in this section of the country. S. G. HUNTER,
Malone, N. Y. *Superintendent Malone Light & Power Company.*

Old-House-Wiring Campaign

To the Editor of the ELECTRICAL WORLD:

SIR:—We have in service over 20,000 meters, of which approximately 12,000 are for residential customers. Statistics have placed residential connections for the average central station at approximately 10 per cent of the total number in the community, and it is hardly possible that our figures are much, if any, better.

If the statistics be true, we have within the limitations of our territory 100,000 prospective electrical consumers. I have previously estimated that there are within the territory we serve from 40,000 to 50,000 unwired houses, which seems conservative enough if the former more carefully prepared statistics are to be relied upon.

Many owners of property are represented in our estimate of possibly 50,000 houses and without doubt can be interested in the wiring of their property. Some of it is logically business that ought to be ours to-day; the

houses are somewhat better than the average and should be wired for electric light. When these houses were built electric light was in its infancy and provisions were not made for using electricity, and to-day the owners of the houses have no inducement to encourage wiring and the expenditure necessary to equip electrically is a serious handicap to all but the more prosperous. The latter class are represented in our connections from time to time in straggling numbers, but something is needed to awaken the interest of those less favored with the world's goods.

Electricity is fast becoming a public necessity. Its manifold uses and many conveniences are being sought out by the housekeeper to-day, and the opportunity to use it is being demanded of the landlords. That they, too, recognize the trend of public opinion is borne out by the great percentage of new houses erected during the past two years that have been equipped for our service. Some inducements of cheaper wiring and fixtures or a time proposition on wiring must be made before any progress is noticeable in increasing our percentage of residential connections among the present unwired class. Aside from the question of the relatively small proportion of unwired houses in our territory, there seems to be some justification for the consideration of the subject of house wiring by central-station interests, and that is the seeming lack of anything like standardized prices on the part of the contracting interests for work of this kind. In marked contrast to this, owing to keener competition and standardized method, are the prices quoted on new-house work. We prosper by one class of business and "mope along" by the other.

Success attending such campaigns has been marked wherever they have been instituted, as is shown by the record of connections made. The conditions in Providence are not different from those elsewhere. What has been successful in one community should be successful here. If houses can be wired successfully in Europe with the concentric system, there is no question but that the same thing can be done in this country. On the whole, our conditions generally are similar to theirs. This class of business is desirable to central stations and electrical contractors and may be made extremely profitable by the installation of lamp-socket devices, which are daily becoming more popular and are invariably intended for day-load or off-peak use.

A possible ultimate return of only $12 each per year from 20 per cent of the available prospective customers would yield the tidy sum of $237,000 per annum. This at least, at the lowest calculation, is our prospect. The possible return is an amount large enough and attractive enough to outweigh any of the disadvantages such a campaign might possess and great enough to yield a net return of sufficient proportions to recompense us amply for all expense incurred. I believe that this figure is an ultimate future possibility—not this year, or even the next year, but I do believe it not unreasonable or impossible of achievement.

Experience of central stations in England in this field should serve as a very important guide for the companies in this country. We are indeed fortunate in being able to profit by such large experiences on the other side.

To my mind the whole matter simmers down to a lack of appreciation on the part of the contractors of the latent possibilities of the unwired-residence field. The majority have been unable, and still are unwilling, to see the opportunities before them, and are not satisfied with a smaller margin of profit per contract secured for this class of work.

The vast majority of the "little fellows" in the business world are content to "mope along" from one year to another, obtaining a decent living from their business and a fair yearly increase in the volume transacted.

Occasionally one arises with a broader conception of his possibilities than his fellow merchants, one who desires a large volume of business, frequent turnovers of his stock, and is content with a small margin of profit. He reduces his overhead charges, systematizes his business, makes former wastes yield a profit, and sets a pace the "little fellow" is unable to follow. He is the successful man in his line, and it is his type that has evolved the "chain-of-stores" idea, the one who develops until finally he comes to be referred to as a "trust."

There are, I believe, as great opportunities among the contracting interests as there have been in other lines already developed to a high degree, but the man of the hour has not yet made his presence felt. Who will be the Moses of the contracting field?

E. R. DAVENPORT,
Sales Manager Narragansett Electric Lighting Company.

Providence, R. I.

Possible Dangers of Concentric Wiring

To the Editor of the ELECTRICAL WORLD:

SIR:—The proposed "Stannos" or concentric wiring system, now being advocated by the National Electric Light Association and certain manufacturers of electrical generating and central-station apparatus, not only presents important problems affecting the hazards of life and fire but, if adopted, bids fair seriously to disturb many lines of manufacture.

As to the merits of the system, it would be difficult at this time to deal very specifically with them, as nothing definite has yet been proposed.

The proposed system presents three probable sources of danger to life and property:

(1) Danger of electric shock, due to personal contact with the bare conductor of a supposedly grounded system where the ground connection has been omitted or improperly made and where the central conductor has become accidentally grounded, or where the continuity of the return conductor has been broken.

(2) Danger of fire, due to poor connections between adjacent lengths of return conductor, cracks around the conductor where kinked or otherwise damaged, or to short-circuits caused by accidental damage to insulation because of the light wall of conductor.

(3) Danger to iron structures and piping systems, due to electrolytic action.

If the return conductor, which in most cases would be exposed, is properly installed, with all joints and grounds properly made, the danger from shock would be less than in the present system; but if a wireman failed to make the ground connection, or made it improperly, the danger to life would be greatly increased. The fire hazard, involving life hazard as well, would be confined more largely to the wire itself and the wiring connections, and this would naturally depend much upon the character of the return conductor and the means provided for making connections with it.

I believe that considerable danger resides in the use of the proposed concentric wire in which the return conductor consists of a light copper tube surrounding the insulation. It is only natural to suppose that in practice this wire would receive a good many kinks in being handled, and that these kinks would be straightened out by the wiremen and the wire be installed without close inspection to determine whether this conductor was cracked at the point where it had been bruised or kinked. If suspended by staples or held by nails, as would sometimes be the case, some of these weak places would be likely to open up, owing to vibration, and to

cause an imperfect contact, resulting in an arc, with the danger of starting fire or at least destroying the wire. Setting a staple too tight might often partially cut the conductor, or a misblow of the hammer might seriously damage it. In many cases there would be no means of replacing the wire, if plastered in or concealed, as has been advocated. It would be impossible for an inspector to know that the wires were run in perfectly good condition, as such defects become apparent only after the system has been in use for some time.

The question of electrolysis is one that should receive careful consideration from those competent to judge in such matters. It would appear that the ground return system would inevitably increase the trouble from this source.

It should not be forgotten that the more simple the installation of a system the more likelihood there is of its being installed by inexperienced people, and in spite of any restrictions which may be placed upon the installation of such a system in the early stages or at any future time, so long as the devices are on the market and are cheaper than devices previously used, they will be purchased and installed by the public without regard for rules.

Is it not almost certain that in a great many cases extensions of concentric wire and fittings will be made in existing ungrounded installations and many new circuits run without any attempt to ground? The flexibility of the wire would suggest to the amateur, as well as the electrician, the convenience of running it concealed by "fishing." In our judgment, the use of this system, if once introduced, cannot be controlled, and hence if it is unsafe for concealed work it should not be placed on the market.

The concerns that would be most likely to be detrimentally affected by the adoption of such a system appear to be numerous manufacturers of wire and electrical and mechanical devices used in distributing systems. Some of these manufacturers would, temporarily at least, be affected greatly.

The disposition of the manufacturers generally appears to be to have the system thoroughly studied and considered to determine whether or not it represents a real advance in the art before it is permitted to be put into service to any extent. Such consideration, in order to be effective, should extend over a considerable period of time. If the system should then be proved to be reliable and desirable, due public notice should be given by the Underwriters as to the date upon which the approval will go into effect, ample time being allowed for the manufacturers who would be affected by such a radical departure from present standards to adjust their business to the new conditions. I believe that such careful consideration would require approximately two years' time, and if the system be passed upon favorably by the electrical committee of the Underwriters, another year's time should be given to the manufacturers in which to prepare for the change.

If the concentric system should be adopted, it would seem appropriate to place the responsibility for making proper ground connections upon the central station, and in order to eliminate as far as possible the danger to life due to the unauthorized use of concentric wire, it would appear desirable that all circuits in all buildings be thoroughly grounded and solidly connected without any fuses in the return conductors. This would be equivalent to grounding the secondaries of all transformers.

The use of this system would require a large line of new fittings, which would replace very many of those now in the market. Insulating joints for lamp circuits would disappear; fiber-lined sockets would be replaced with cheaper forms; present forms of outlet boxes would yield to more convenient forms; fuse boxes and panelboards would become single-pole, with no fuses for the neutral conductor.

The advocates of the concentric system state that they are not necessarily working for the adoption of this particular system, but for some system that will cheapen the cost of installation and thereby make it possible for the central stations to secure a large increase in load by obtaining customers who are unable to pay the present price for wiring their buildings. It occurs to me that, since the cost of installation is a small item as compared with the cost of energy and charges often made by central stations for bringing the service to the buildings, unless some suitable reduction is made in the rates the new system will not bring the results desired.

Assuming that it is safe to adopt grounded systems, it would be safer and disturb present conditions less to use rigid or flexible steel conduit in smaller sizes (0.25-in. or ⅜-in.), a single conductor, corresponding to the present No. 14 rubber-covered wire, being used for conduit purposes, thus making it possible to pull in and replace burned-out wires where concealed, at the same time giving proper protection to the wire by means of the heavier return conductor in the form of flexible or rigid conduit. A flexible conduit would serve practically all purposes for exposed work for channeling in plaster and fishing through partitions, etc., without danger of becoming kinked in the process of installing. This plan would not disturb the manufacturer of wire to a great extent, and would admit of the continuance of the use of outlet boxes, condulets, unilets and a great variety of fittings of this character, with the addition of suitable means for electrically connecting the various runs together, grounding the fixtures, etc.

While this system might not be so cheap as the concentric system, yet it would be far safer, and it should be considerably cheaper than the present system.

R. B. BENJAMIN,
President Benjamin Electric Manufacturing Company.

Chicago, Ill.

Concentric Wiring

To the Editor of the ELECTRICAL WORLD:

SIR:—From a safety standpoint the recommendation regarding the concentric system of wiring by such an authority as Mr. W. H. Blood, Jr., insurance expert of the N. E. L. A., certainly carries great weight.

One consideration to be borne in mind, however, is whether this particular class of wiring would tend to bring to electric companies a class of customers whose revenue would not carry the charges involved in their service. This is especially important to companies that have no minimum bills, though the remedy for this would probably lie in a proper rate, rather than in an attempt to prevent economical methods of wiring. Every new development always possesses certain disadvantages, but, on the whole, I think the introduction of the concentric wiring would represent a distinct advantage to the central-station business because it would certainly aid in securing large residential business along existing lines which cannot be secured now on account of the high price of wiring.

It is well known that the proportion of residences secured by any central station is pitifully small. If the cheaper method of wiring brings forward a class of customers who under existing rates do not pay their cost, the rates should be adjusted to render the service profitable.

LEON H. SCHERCK,
Central Hudson Gas & Electric Company.

Poughkeepsie, N. Y.

FIG. 1—BIRD'S-EYE VIEW OF PANAMA-PACIFIC INTERNATIONAL EXPOSITION AT SAN FRANCISCO

Illumination of Panama-Pacific Exposition

Flood-Lighting and Screened Arc Lamps Used for the Purpose of Bringing Out Architectural Features of Palaces

BY G. L. BAYLEY,

Chief of Mechanical and Electrical Department, Panama-Pacific International Exposition

AS an index of the preparedness of the Panama-Pacific International Exposition to open its doors on schedule time, it is interesting to note that the illumination was given a trial one month in advance of the official opening day—Feb. 20.

The general scheme adopted was to feature the beauty of the buildings, courts, paintings and decorations and make the lighting subservient to this end. Flood-lighting from screened searchlamps has been used on a large scale, and other light sources have been hidden as far as possible, except in formal gardens, where the treatment admits of the use of incandescent standards.

In general, the outside walls of the buildings are lighted from a series of 30-ft. standards, spaced 60 ft. to 75 ft. apart, parallel with the building walls. Two types of standards have been used, one having a large shield of staff with three openings covered with orange-colored translucent fabric (see Fig. 7), the other type consisting of three canvas banners painted with heraldic designs. Magnetite-arc lamps have been used for both types, and the construction is such that the lamps are so inclosed by the decorations as to be hidden from general view.

Where the standards are within 50 ft. of the building walls three lamps are used, and five lamps where the distance is 100 ft.

All building walls are plastered in imitation of Roman travertine marble, which has a soft cream color and a stratified texture. A good example of this type of plaster work is found in the inside of the Pennsylvania Railroad Station in New York. Many special features of the palace exteriors are richly treated with cast-staff ornaments and sculpture to correspond to the plastic surfaces. Color and mural paintings are also incorporated into the decorative scheme.

Uniform wall illumination prevails, and the colors and decorations which mark the entrances to the buildings and courts are given their true tone and definition by this form of lighting. The light which filters through the translucent fabric openings in the staff standards and the canvas banners adds a pleasing bit of color to the night picture quite in harmony with the general color scheme. The staff shields are shown in Fig. 7, and the banner standards in Figs. 6 and 8.

A moderate amount of light is reflected from the building wall surface to the adjacent roadways, but not sufficient for traffic requirements. To augment this

FIG. 2—COMPLETED PANAMA-PACIFIC INTERNATIONAL EXPOSITION BY NIGHT

FIG. 3—ITALIAN TOWERS AT ENTRANCE TO COURT OF PALMS

reflected light incandescent standards have been installed along the curbs of the roadways. Each of these standards carries an 18-in. Beaux Arts glass ball and a 250-watt lamp.

Enough incandescent standards of the candelabra type, carrying from one to twenty-one glass balls, light the South Gardens—a large area in front of the main group. These may be seen along the edges of the mirror pools in Figs. 4 and 5. The architectural treatment of this garden is French Renaissance, and the lighting plan harmonizes perfectly with the architectural treatment. Three large mirror pools in this garden heighten to a remarkable degree the interest of the night effects.

The Court of the Universe, an elliptical-shaped area, depends primarily for its lighting upon two great lighting shafts at the foci of the ellipse. These shafts are in reality the columns of large fountains and are 5 ft. in diameter by 30 ft. high, being made of a special glass bent to represent the flutes. The daylight impression is that the shafts are of marble. Each shaft contains ninety-six 1500-watt nitrogen-filled lamps, dif-

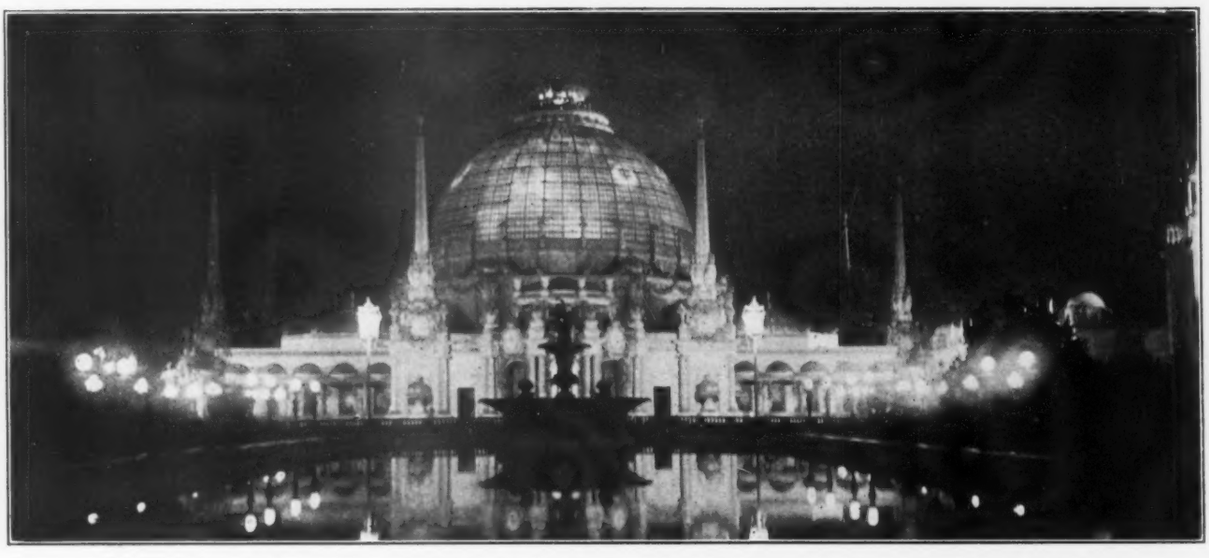


FIG. 4—PALACE OF HORTICULTURE WITH ITS IMMENSE GLASS DOME ILLUMINATED FROM WITHIN

FIG. 5—TOWER OF JEWELS, THE CENTRAL TOWER OF THE EXPOSITION, ON WHICH ARE 100,000 VARICOLORED JEWELS

fusion being secured by sand-blasted glass screens placed between the lamps and the glass forming the shaft. Fans are used to carry away the heat produced, and means are provided to switch off the lamps automatically in the event of failure of air supply. The intrinsic brilliancy of these great pillars of light is sufficiently low for comfort, and at the same time a sufficient volume of light is furnished to cover an area of approximately 247,000 sq. ft. adequately. The colonnades of this court and its approach are lighted from lamps concealed in the flutes of each column, and a very uniform and satisfactory illumination has been secured.

Minor court lighting has been made to harmonize with the architecture, color and treatment of each court. Concealed light sources have been used generally for this purpose. A decided departure, however, is to be found in the Court of Abundance, where, to carry out the idea of the architects and artists, free-burning gas torches and steam have been used to supplement the electrical effects.

Tower Lighting

Towers, of which there are four, in addition to the Tower of Jewels and the Organ Tower of the Court of Abundance, are illuminated by searchlamps having wide

FIG. 6—COURT OF UNIVERSE, LOOKING NORTH, AND LAGOON

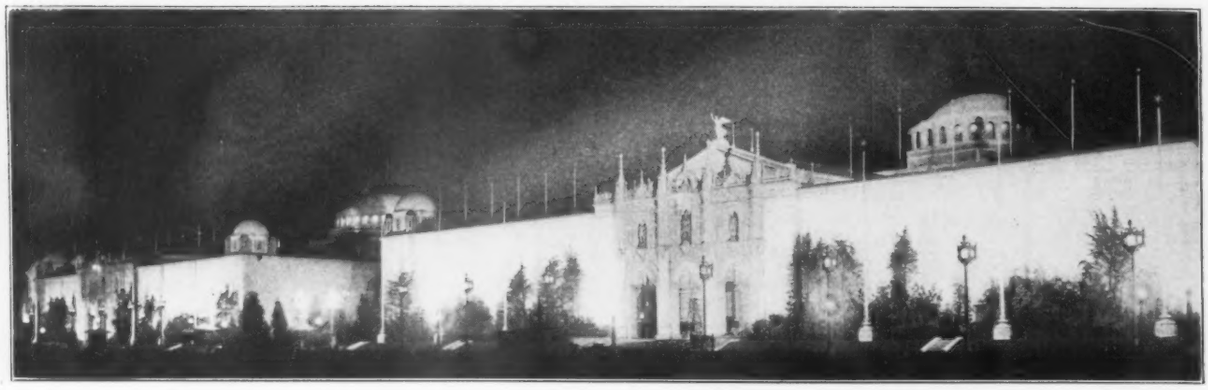


FIG. 7—FAÇADE OF FOOD PRODUCTS BUILDING LIGHTED FROM ARC LAMPS IN STANDARDS

angle doors arranged to produce a flood of light instead of a narrow beam. Fig. 5 shows the main tower, and Fig. 3 shows two of the four minor towers.

Perhaps the unique feature is the illumination of the 435-ft. Tower of Jewels, which requires fifty 18-in. and four 30-in. searchlamps for its illumination. These projectors are placed on the roofs of various buildings and concealed on top of the Exposition gateways. The upper portions of this tower are trimmed with imitation jewels of various colors, ranging in size from 21 mm. to 47 mm. The jewels were made in Austria, of special glass, and more than 100,000 are used for the decoration of the tower. The jewels are suspended so as to be free to swing with the air currents and, under the rays of the searchlamps, show a remarkable change of color and action. At each level of the tower concealed lights are installed which tend to relieve the shadows and introduce a shading of color.

The gala effect of the night picture is heightened by the illumination of the flags which line the parapet walls of the main group of buildings. This is accomplished by wide-angle 500-watt incandescent projectors, three being required to produce a field of illumination for each flag. The scene is further enlivened by the lighting from within of the domes, minarets and clerestory windows of the various buildings.

Flood-lighting by seventeen 18-in. projectors placed on the roofs of nearby buildings marks the Palace of

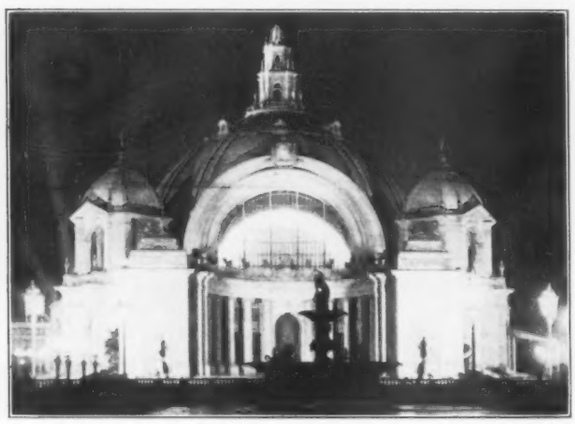


FIG. 8—FESTIVAL HALL

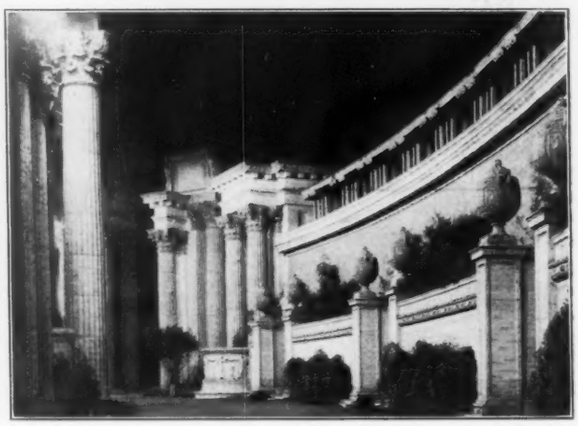


FIG. 10—ROTUNDA NEAR FINE ARTS BUILDING

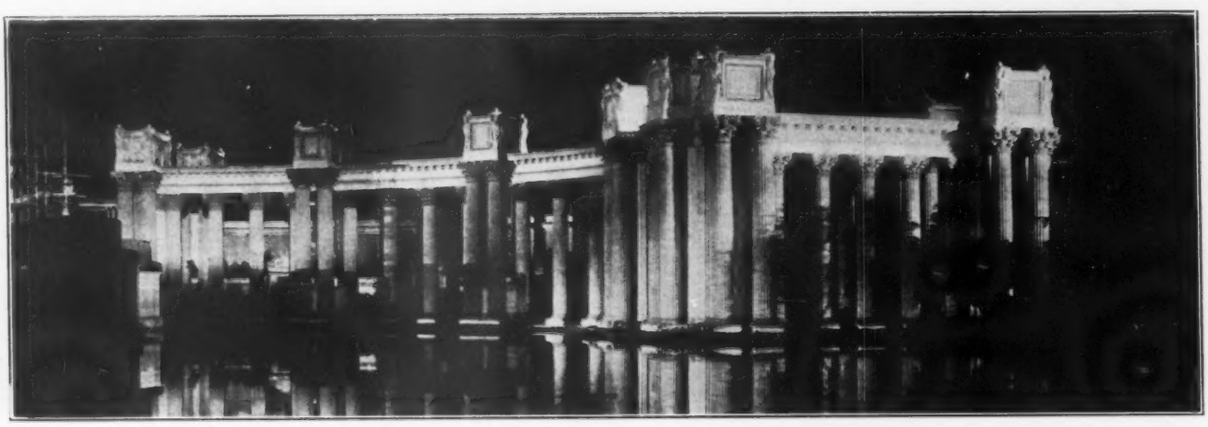


FIG. 9—NORTH END OF PALACE OF FINE ARTS REFLECTED IN ITS LAGOON

Fine Arts. The only lamps on the building proper are those concealed within the colonnade. Fig. 9 shows a portion of this building, which borders on a lagoon, and the reflections produced at night form a picture which every visitor to the Exposition will remember. The photographs give no conception of the color of the structure and the foliage surrounding the lagoon. Fig. 10 shows the illumination within the colonnade produced by lights placed along the cornice line.

Spectacular lighting features are concentrated in a battery of forty-eight 36-in. searchlamps placed on a promontory jutting out into the Bay of San Francisco. Fig. 11 shows the battery in action, but a number of the rays do not show up in the picture, owing to the fact that color screens were being used. As seen from the hills of San Francisco, these beams ordinarily pro-

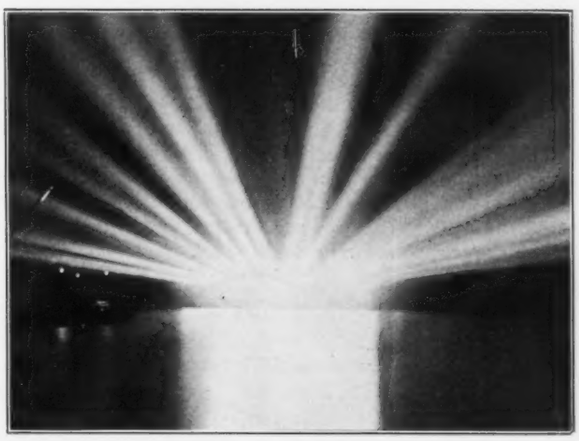


FIG. 11—BATTERY OF PROJECTORS ON SAN FRANCISCO BAY

duce a wonderful aurora as a background for the Exposition. On special occasions they are used to illuminate various steam effects and pyrotechnic demonstrations. The size of this battery of searchlamps is most impressive, and while it is not a part of the illumination proper, it will doubtless contribute much to its success, particularly during periods of high fog, when various colors can be thrown on the fog and reflected upon the Exposition.

The illumination will doubtless prove to be one of the greatest of the Exposition's attractions, particularly as its arrangement admits of many changes and combinations of colors and varied light intensities.

Ideal exposition illumination is one that secures a lighting effect which harmonizes with the work of each architect, sculptor and artist and one that supplements the feeling which each of these is endeavoring to express. Fundamental considerations are those of scale and mass, particularly where detached units, such as standards, are associated with architectural features. Above all, the means employed and the devices used must not be prejudicial to the daylight picture. With color added, another important and difficult element is introduced. Details of the decoration of standards and color in the light itself should not introduce notes foreign to the harmony of the general esthetic scheme. Such processes of reasoning were employed in the solution of the illumination problem in the present instance.

In brief, the foregoing requirements are set forth to indicate the many points of view from which the illumination must be considered and the necessity of the representation of each of the artistic interests concerned in the settlement first of the general scheme and later of the numerous details required to put it into effect. That the illumination of the Exposition is an artistic triumph is due to the same co-operation which produced the architectural plan.

The lighting of the Exposition was handled by the mechanical and electrical department, under Mr. G. L. Bayley as chief; the plans for the lighting were produced by Mr. W. D'A. Ryan, chief of the bureau of illumination, and the work was installed under the immediate direction of Mr. L. F. Leurey, assistant chief of the mechanical and electrical department. The staff ornamentation of the standards, both as to design and execution, is due to Mr. Paul Denivelle, superintendent of texture and modeling. Mr. Jules Guerin, as chief of color, was responsible for the color scheme used and contributed many valuable suggestions, based on his long experience with stage productions. Mr. George Kelham, as chief of architects, lent valuable aid in the design and arrangement of standards relative to the architectural features. Constructive criticism was also rendered by other members of the division of works.

NEW-TYPE MERCURY WATT-HOUR METER

Principle of Operation Somewhat Different from That of Meters at Present in Use

BY A. A. RADTKE

READING an article by E. Hagenbach, "Elektromagnetische Rotationsversuch," in the *Annalen der Physik*, and one by E. F. Northrup, "Forces in the Interior of an Electric Conductor," in the *Physical Review*, suggested the possibility of a motor watt-hour meter having a principle of operation somewhat different from that of the watt-hour meters used at present. As a consequence two models were constructed which, on being operated, gave some interesting results of which this article is only a partial discussion.

Watt-hour meters in general are constructed in such a manner as to utilize, or depend for their operation on, the magnetic fields surrounding or linking conductors which carry currents. In the meter described in this article this is only true of the pressure side of the structure, the current side exerting its force to produce rotation through the means of the field within a conductor.

The motor portion of this meter, a vertical section of which is shown in Fig. 1, consists of a rotatable soft-

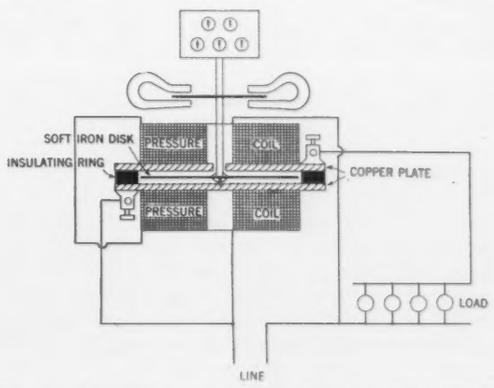


FIG. 1—SECTION OF MERCURY-TYPE WATT-HOUR METER

iron disk mounted within a mercury chamber formed by fastening two heavy circular copper plates to the two sides of an annular insulating ring, and two associated field coils. These field coils are placed directly above the upper plate and beneath the lower plate forming the mercury chamber and are wound with fine wire. The other features of the meter are quite usual, consisting

of a set of drag or damping magnets, a damping disk and a counting mechanism.

The two field coils are connected in series across the line in such a manner that the magnetic fields due to the current in them "buck," and thus magnetize the disk radially, producing, say, a north pole at the periphery and a south pole at the center. Since the two coils are equidistant from the disk, their vertical pulls on the soft-iron disk balance each other, and consequently there is no end thrust on the bearings due to the field coils.

When the mercury chamber is so filled that the mercury stands a little higher than the bottom of the upper copper plate of the chamber and entirely fills the space between the two plates a current will traverse the disk in a direction parallel to the shaft. In its passage through the disk the current therefore sets up a magnetic field of concentric circular lines of force having a maximum intensity at the periphery of the disk and zero intensity at its center. The operation of the meter is then as follows: At the periphery of the disk there is a magnetic pole of a strength proportional to the current in the field coils and therefore to the line voltage;

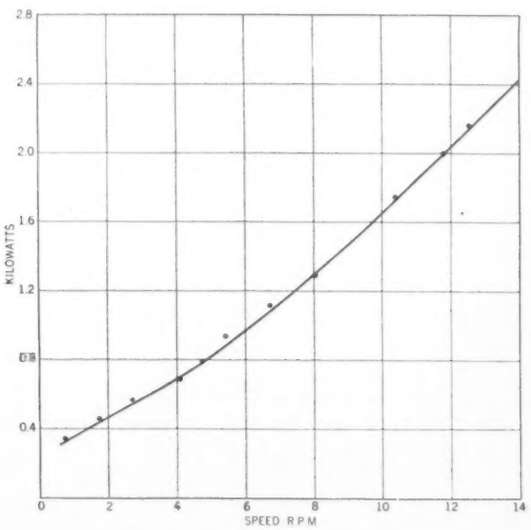


FIG. 2—PERFORMANCE CHARACTERISTICS AT VERY LOW SPEEDS

acting on this pole in a circumferential direction is a magnetic field proportional to the current through the disk and therefore to the line current; the torque acting on this pole is proportional to the product of the strength of the pole by the intensity of the field and therefore to the power supplied to the load. A magnetic pole also exists at the center of the disk, but since the field due to the current through the disk is relatively weak in the central portion of the disk, the torque produced on the pole at the center is negligible compared with that on the pole at the periphery. The action of the motor element may, in short, be looked upon as due to a pole at the periphery of the disk which is urged along the concentric lines of force due to the current through the disk, whereas the opposite pole at the center of the disk, being situated in a zero field, has no force exerted on it.

A variety of tests made with this device led to the following conclusions:

(1) Since the length of current element within the meter, that is, the thickness of the disk, is small, the torque for small currents is not sufficient to produce a good energy-measuring instrument, but for large currents the torque is ample.

(2) The construction is adapted to measure both alternating and direct currents.

(3) A meter of this kind designed for large currents will start on a very small percentage of its rated load.

In Fig. 2 is shown the lower portion (from zero to 10 per cent full-load) of a load-speed curve when the meter is operating on sixty-cycle alternating current. From the curve some idea may be gained of the starting qualities of the meter and of the probable accuracy on light loads. In considering this curve it should be borne in mind that it represents only the lower tenth of the range of the meter.

THE COOLIDGE X-RAY TUBE

Preliminary Data on the Wave-Form of Current Passing Through It

BY RALPH BOWN

VARIOUS attempts have been made to measure the wave-form of the current passing through the ordinary X-ray tube, both by direct and by indirect methods. Duddell and Snook[1] have given a few curves obtained by connecting an oscillograph element of high sensibility directly in series with the tube. The accuracy of these curves has been questioned by Wertheimer[2], who used a point-to-point method in his determinations. The object of this article is to record some rough preliminary data which have been obtained

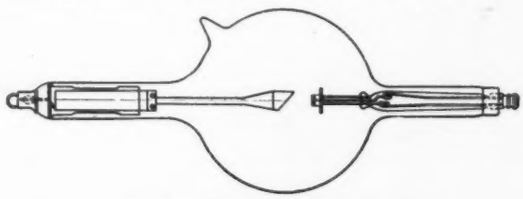


FIG. 1—COOLIDGE X-RAY TUBE

on the new Coolidge X-ray tube by a method which it is believed has certain advantages over methods previously in use.

The perfection of the Coolidge tube[3] marks a new departure in X-ray operation. It changes the production of X-rays of a given intensity and penetrating power from a matter of experience and guesswork to a matter of exact and predetermined performance, and it facilitates the production of large amounts of Roentgen energy. The tube, of which an illustration is given in Fig. 1, consists essentially of a cathode formed of a spiral of tungsten ribbon, surrounded by a molybdenum cylinder which helps to focus the cathode ray on the wrought tungsten target. All parts of the tube are treated so as to remove fully the occluded gases, and the extremely high initial vacuum is thus maintained during the operating life of the tube. The electrons of the cathode stream are not furnished by the ionization of residual gas but are obtained directly from the tungsten spiral, which is heated to incandescence by an insulated storage battery outside the tube. The rate of electron emission from the hot spiral is a function of its temperature, so that by regulating the current which heats the spiral and by regulating the potential impressed on the terminals of the tube the operator can accurately control the number and velocity of the electrons and therefore the intensity and penetrating power of the Roentgen radiation.

[1]Duddell, *Journal Roentgen Society*, Vol. 4, July, 1908, pp. 100-114. Snook, *Journal of the Franklin Institute*, October, 1907, pp. 273-283.

[2]Alfred Wertheimer, *Journal Roentgen Society*, October, 1911.

[3]For detailed description see ELECTRICAL WORLD Digest, Vol. 63, No. 4, Jan. 24, 1914, p. 220, or the original article by W. D. Coolidge, *Physical Review*, Second Series, Vol. 2, No. 6, December, 1913.

The energy efficiency of an X-ray tube is secondary to questions of performance. A desirable characteristic of an X-ray outfit is the ability to produce good photographic records through dense media with very short exposures. It is believed that a study of the wave-form of the current in the tube may indicate

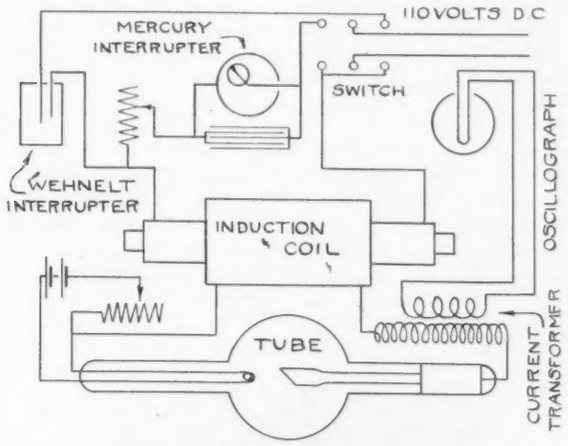


FIG. 2—ARRANGEMENT OF APPARATUS

methods of developing such characteristics. The accompanying curves are presented here as a matter of general information with the hope that more detailed results and conclusions may be presented later.

Fig. 2 shows the connections of the apparatus used in these measurements. It consisted of an induction coil, operated either with a Wehnelt or a mercury turbine interrupter, a Coolidge X-ray tube and a step-up series transformer the secondary of which was connected to a Duddell high-frequency oscillograph. The series transformer allows the use of a standard oscillograph and makes it possible to obtain large-size records of very small currents.

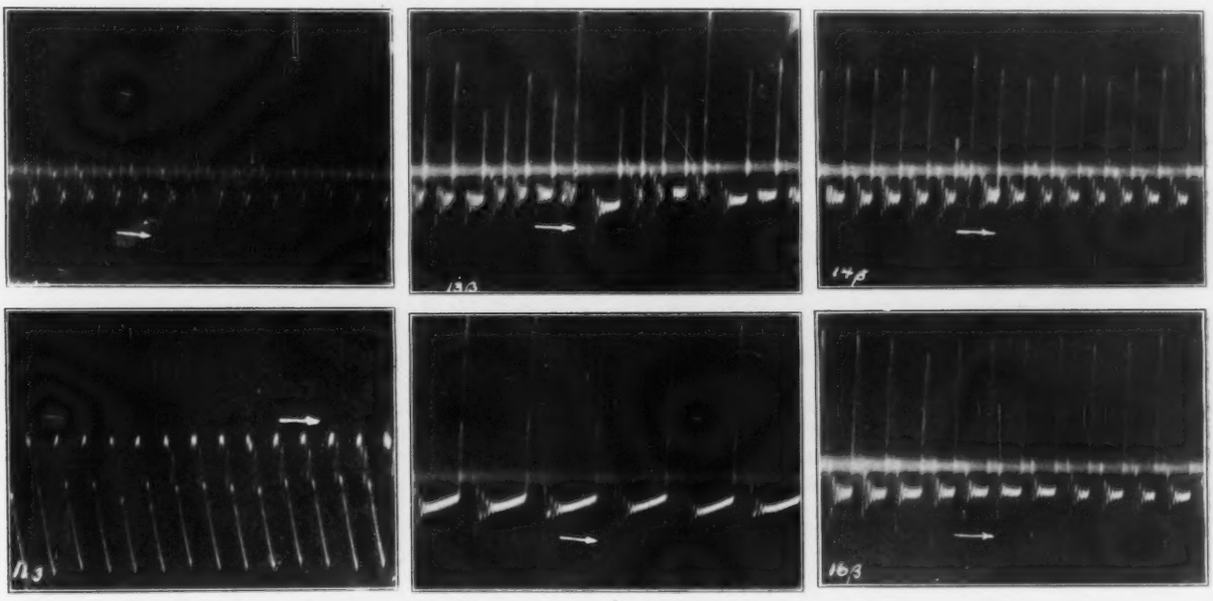
Figs. 3, 4 and 5 are oscillograms of the secondary current of the induction coil using three different immersions of the Wehnelt interrupter. At each break in the primary circuit the secondary current which passes through the tube rises rapidly to a maximum and then drops, with a few oscillations, back to zero. The zero line of the current has been displaced below the center of the plate in order to include the peaks in the record. It is not unlikely that the oscillations which are characteristic of circuits of this type are caused by the action of the capacity and self-induction of the tube, batteries and coil. The primary current recorded in Fig. 6, corresponding to the secondary current in Fig. 3, shows how these oscillations are impressed back on the primary circuit.

All secondary current records are to the same scale, the mean value of the current in each case being about 20 milliamperes and the plate velocity such as to make the frequency in Fig. 8 about sixty-four impulses per second. Figs. 7 and 8 are records taken under the same tube conditions as for Fig. 5 but using the mercury turbine interrupter operating at two different speeds. The impulses are thus more regular, but the wave-form does not radically differ from that obtained when using the Wehnelt interrupter.

The writer desires to acknowledge his indebtedness to Prof. J. S. Shearer, of Cornell University, whose cooperation made the taking of these records possible.

Cable Currents Due to Earth's Magnetic Field

On cable-laying ships during rough weather the effect of the earth's magnetic field sometimes makes it extremely difficult to take the galvanometer readings which are watched continuously to detect faults in the cable insulation. On board the vessel the cable, before being laid, is usually coiled in large tanks which are filled with water since if the covering of the cable is allowed to get dry its insulation becomes impaired. By means of a galvanometer the insulation resistance is measured continuously while the cable is being paid out from the stern, and any leakage fault present is immediately made known by a deflection of the instrument as the faulty part comes out of the tank of water and into the air. When the sea is rough and the ship rolls, the cutting of the lines of force of the earth's field by the many miles of cable coiled in the tanks produces an emf in the cable which causes the galvanometer to swing in synchronism with the vessel, necessitating the application in bad weather of a high-resistance shunt to damp out the effect.



FIGS. 3 TO 5 (TOP ROW) AND 6 TO 8 (BOTTOM ROW)—COOLIDGE TUBE CURRENTS

Development of Three-Color Illumination

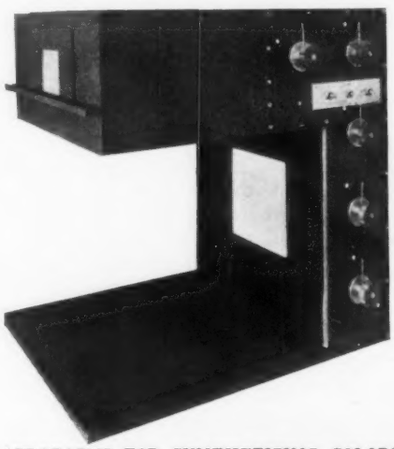
Recent Progress in Color Synthesis by the Use of Pure Color Screens and Special Apparatus for Demonstration Purposes

NOTABLE advances in the synthesis of colored light were shown at a meeting of the New England Section of the Illuminating Engineering Society held on Feb. 5 at the Engineers' Club, Boston, Mass., the speaker being Mr. Munroe Rhodes Pevear, of the architectural firm of Foss & Pevear, Boston, who has been investigating this subject for about four and one-half years and who as the result of his researches has developed methods of screen coloring which yield values of 100 per cent effectiveness as primary standards and which have overcome the perishable qualities of dyes formerly employed in this branch of illuminating engineering. A résumé of Mr. Pevear's discussion, with a brief description of the apparatus employed, is given below.

All colors of the solar spectrum are present in daylight, but at different times of day these vary considerably in intensity. The famous "yellow day" undoubtedly lacked blue and violet light, so that all blue and violet objects looked black or nearly so. Within the past few years the production of artificial daylight has been studied with scientific care. Dr. Herbert E. Ives uses lightly tinted filters which dim the brighter red and green until their intensity matches that of the blue given out. The sources of our artificial illumination give out less blue and violet light than red, yellow and green rays, with the exception of the mercury arc, which, as is well known, is rich in blue and violet. Dr. C. P. Steinmetz has attempted to reduce the loss in efficiency which occurs where color filters are employed by using the mercury arc in conjunction with glow lamps, building up with the combined rays to produce the qualities of daylight. The Welsbach mantle gives a color balance nearest daylight, being 4.1 per cent brighter in red, 4.5 per cent brighter in green, and dimmer by 8.5 per cent in blue, considering red, green and blue of 33.3 per cent value each.

Most of the work toward securing artificial daylight has been aimed to realize a more accurate color discrimination at night or in poorly illuminated rooms, to give sunlight color qualities to fabrics, or to cigars, color printing, chemical reactions, etc. Even sunlight does not permit extremely accurate color matching, which means the same appearance under all conditions of illumination. Matching can be successfully done by using merely the three primary colors—red, green and blue-violet—provided these colors are pure. Over 1500 dyes have been tested in the past four and one-half years in the search for pure colors which will endure through the life of the tungsten lamp, and exhaustive researches have also been made with pigments. Colors of extreme purity have been produced as a result of these investigations. The preparations now available will not fade or peel during the life of the dipped lamp, and they open a new field of service in connection with the lighting of theaters and show windows, the matching of textiles in manufacturing plants, and in many other applications.

Apparatus devised by the author and his partner to synthetize colors for demonstrative purposes is illustrated in the accompanying half-tone. It consists of an L-shaped box 24 in. high, 22 in. long and 17 in. wide, with a switchboard panel of 0.5-in. ebonized asbestos on one end, a centrally mounted screen or target 6 in. square for the exhibition of color values, rheostats and concealed lamps. In the upper part of the box and at the left-hand end are three light-proof compartments containing respectively a 40-watt lamp behind a filter of pure red, a 40-watt lamp behind a pure green filter, and a 60-watt lamp behind a blue-violet filter. The axes of the lamps are parallel to the plane of the reflecting screen shown in the half-tone, which is about 14.5 in. distant from the central compartment. On the under side of the box and concealed from view is a 25-watt clear tubular lamp which furnishes white light for tinting. To take off eye strain in watching the vertical screen a translucent contrast border 0.5 in. wide is provided around the screen, illumination being effected by a 15-watt spherical bulb lamp in the rear of the box.



APPARATUS FOR SYNTHETIZING COLORS

In the front of the box at the left-hand end is set a diffusing plate 5.5 in. long by 3.5 in. wide, with a 1-in. metal shelf and 0.5-in. groove along the front and bottom of the plate in which filters can be set for examination of their color value. A removable slide is provided with a second diffusing plate between the window and the compartment lamps, so that the compartments will be light-tight when the window is not in use.

Each lamp is in circuit with a dimmer consisting of "Nichrome" wire wound in a torus and mounted by fiber supports on the panel at the end of the box, through which project the handles of the rheostat contact arms. Although all lamps are operated from a 110-volt supply, the heating of the rheostats is negligible. A switch is provided for the compartment lamps, one for the tinting lamp and one for the lamp at the rear of the target. A metal cover at the top of the box is provided with five 0.5-in. holes above each lamp to dissipate heat. By the simple expedient of adjusting the rheostats and cutting lamps in or out of circuit the production of a wide range of color values is easily effected.

An example of the range of the apparatus is evidenced by the manifestations of color phenomena shown at the Boston meeting: First, the three colors at their full intensity, singly or in pairs; when two are mixed they produce yellow, magenta or cyan-blue, the three pigment primaries. Second, starting with pure green light and varying the intensity of one color at a time, all the colors of the spectrum were produced, plus the purples. Third, white light obtained by the three filters in simultaneous operation was compared with light of

the same intensity from an undipped bulb. Fourth, a normal spectrum made with the same three colors. Fifth, tints and shades of the colors first seen were shown, the tints being produced by adding undipped white light. The action of lights upon colored pictures was then shown, followed by the illumination of a model theatrical drop.

For show-window and picture-gallery illumination use can be made of colored lamps with efficient reflectors. The reflectors not only intensify the light but diffuse the color, so that it becomes mixed in a short or restricted area. While such illumination is not inexpensive, it gives the user a very even and good "daylight" quality, which when used at night would give a more truthful display of costly goods or fine works of art. But in these cases the three colors must be unfading and the arrangement and number so chosen that when the lamps are switched on the objects illuminated will receive a perfect blend of light.

In the illumination of ballrooms or reception rooms the three colors and undipped lamps should be placed so that the lamps are invisible, but the rays should be blended and reflected from a white ceiling or wall, diffusing the whole room with colored light by which a simple arrangement of dimmers could be made to change in color through the whole spectrum, plus the purple colors. The undipped lamps would be used for fixed illumination or for tinting the varying colors. For the ceremonial work of secret orders cove lighting can well be used. In the same way, the three pure colors can be used in sign lighting, hiding the lamps and blending the colors on the white background of the letters, using mechanically operated dimmers, and not flashers.

Stage lighting, in which colored light is extensively used, involves one of the most interesting problems in three-color illumination, for it not only embraces variable color illumination, but the varying of colored light upon colored pigments as well. Lamps used in American theaters are colored by dipping, and the coating under the action of light and heat fades or peels off, so that re-dipping must be done every two or three weeks. The use of red, blue and amber lamps does not give the refined results now possible. The true primaries of light are mutually exclusive in color, none containing a trace of another. The ordinary stage colors are not mutually exclusive in color, some containing traces of another. Hence, when they are mixed, the result is not a true mixture but a reinforcing of the one by the trace of it contained in the other. In the average theater there are eight or nine separate locations from which the same or totally different color blends could be made. The application of pure primary colors to practical illumination is in its infancy to-day, and the results of investigation indicate that an extended development is to be expected in this field in the near future.

Locomotive Cinders for Fuel

A small central station in the Middle West having a maximum load of about 120 kw at its December peak is situated a few miles from a division headquarters of a railroad, from the roundhouse of which a considerable amount of locomotive cinders are taken each day. As the town is some distance from coal mines, these locomotive cinders seemed to offer a cheap fuel with proper provision for burning, so that several years ago the central-station company installed equipment for burning this fuel and has used it regularly over long periods of time. The plant has two common horizontal fire-tube boilers, 6 ft. by 18 ft. and 6 ft. by 16 ft. respectively, equipped with the ordinary height of stacks and common settings. The only unusual thing about the equipment is the ash pit, which is tightly closed and supplied with air from a 24-in. fan blower driven by a 6-hp engine. A thick bed of cinder fuel is maintained over the grates, this bed being ordinarily about 6 in. in depth. The station output is not metered, but from the figures available it is estimated that the fuel consumption is from 10 lb. to 15 lb. of cinders per kw-hr.

STATIONARY MOTORS IN CENSUS REPORT

Returns Show Large Increase in Both Number and Total Rating

Stationary motors in service in 1912, as reported by central electric stations to the Bureau of the Census, show a large increase, in both number and rating, over preceding years. The number reported for the United States in 1912 was 435,473, with a total rating of 4,130,619 hp. The number compares with 167,184 in 1907 and is therefore an increase of 268,289, or 160.5 per cent. The 1907 total number compares with 101,064 in 1902, an increase of 65.4 per cent. The total rating for 1912 compares with 1,649,026 hp for 1907, an increase of 150.5 per cent. The total rating in 1907 compares with 438,005 hp in 1902, an increase of 276.5 per cent. In the ten years the number of motors increased 334,409, or 330.9 per cent, and the rating 3,692,614 hp, or 843.1 per cent. The average number of stationary motors per central electric station in 1912 was 83, as compared with 35 in 1907 and 28 in 1902. The average rating of stationary motors per station in 1912 was 791 hp, as compared with 350 hp in 1907 and 121 hp in 1902. The average rating of stationary motors per machine in 1912 was 9.5 hp, as compared with 9.9 hp in 1907 and 4.3 hp in 1902. The averages for commercial stations were higher, particularly in number per station and horse-power rating per station, than the averages for municipal stations. Table I shows the averages divided between the two classes of stations.

TABLE I—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS —STATISTICS ON STATIONARY MOTORS SERVED

	Census	Total	Commercial	Municipa
Average number per station	1912	83	113	14
	1907	35	47	4
	1902	28	35	2
Average horse-power per station	1912	791	1084	105
	1907	350	467	25
	1902	121	155	4
Average horse-power per machine	1912	9.5	9.6	7.5
	1907	9.9	9.9	7.0
	1902	4.3	4.4	1.7

Table II shows the number and rating of stationary motors in 1912, 1907 and 1902 for the United States as a whole and for the different groups of states. The census classification of states was published in detail in the ELECTRICAL WORLD on Jan. 16, 1915, page 161.

The Middle Atlantic States showed in 1912 the largest totals in number and rating of stationary motors, 124,416, with an aggregate of 1,213,681 hp. The East North Central States were not far behind in number of stationary motors with 114,404, but were materially lower, with a total rating of 799,421 hp. The Pacific States, although showing a much smaller number, 32,865, ranked next in rating, with 647,733 hp. The largest percentage of increase in rating in the last census period of five years was shown by the South Atlantic States, 278.5 per cent.

The Middle Atlantic States in 1912 had 29.4 per cent of the total horse-power rating of stationary motors in the United States; in 1907 they had 33 per cent and in

1902 34 per cent. This group of states, together with the East North Central group, which had in 1912 19.4 per cent of the total rating of stationary motors, and the Pacific States, which had 15.7 per cent, had 64.5 per cent of the total for the entire United States.

Of the total rating of stationary motors served by central electric stations in the United States in 1912, 4,130,619 hp, New York had a larger proportion than any other state. It had 795,256 hp, or 19.3 per cent of the total. California was next with a total rating in stationary motors of 603,742 hp, or 14.6 per cent. Pennsylvania had 333,414 hp, or 8.1 per cent; Illinois, 315,659 hp, or 7.6 per cent; Massachusetts, 228,868 hp, or 5.5 per cent, and Michigan, 174,009, or 4.2 per cent. The California figure represented a gain from 200,067 hp in 1907 and 50,296 hp in 1902. The New York record represented an increase from 393,955 hp in 1907 and 109,277 hp in 1902. The largest average horsepower capacity of stationary motors shown by any of the states in 1912, 38.3 hp, was reported for Montana. Utah showed an average of 35.9 hp, South Carolina 28.5 hp, Georgia 25.8 hp and Nevada 22.4 hp. The average rating in other states named was as follows: New York, 9.6 hp; California, 20.8 hp; Pennsylvania, 11.5 hp; Illinois, 6.8 hp; Massachusetts, 6.7 hp; Michigan, 9.5 hp.

TABLE II—CENTRAL ELECTRIC STATIONS—NUMBER AND HORSE-POWER RATING OF STATIONARY MOTORS—1912, 1907 AND 1902

Division	1912		1907		1902		Average Rating			Per Cent of Increase in Horse-power			Per Cent of Total Horse-power		
	Number	Horse-power	Number	Horse-power	Number	Horse-power	1912	1907	1902	1902–1912	1907–1912	1902–1907	1912	1907	1902
United States	435,473	4,130,619	167,184	1,649,026	101,064	438,005	9.49	9.86	4.33	843.1	150.5	276.5	100.0	100.0	100.0
Geographic divisions:															
New England	55,042	391,308	23,841	154,720	12,736	62,163	7.11	6.49	4.88	529.5	152.9	148.9	9.5	9.4	14.2
Middle Atlantic	124,416	1,213,681	34,108	544,020	29,938	149,083	9.76	15.95	4.98	714.1	123.1	264.9	29.4	33.0	34.0
East North Central	114,404	799,421	49,345	307,558	23,257	80,304	6.99	6.23	3.45	895.5	159.9	283.0	19.4	18.6	18.3
West North Central	47,540	316,113	19,027	138,027	9,767	33,331	6.65	7.25	3.41	848.4	129.0	314.4	7.7	8.4	7.6
South Atlantic	26,163	361,011	8,948	95,373	2,516	16,541	13.80	10.66	6.57	2,082.5	278.5	476.6	8.7	5.8	3.8
East South Central	7,592	62,081	3,039	21,656	3,935	7,510	8.18	7.13	1.91	726.6	186.7	188.4	1.5	1.3	1.7
West South Central	15,337	103,765	7,220	42,597	10,633	11,024	6.77	5.89	1.04	841.3	144.1	285.6	2.5	2.6	2.5
Mountain	12,114	235,506	6,091	94,960	2,394	20,953	19.44	15.59	8.75	1,024.0	148.0	353.2	5.7	5.8	4.8
Pacific	32,865	647,733	15,565	250,205	5,888	57,096	19.71	16.07	9.70	1,034.5	158.9	338.2	15.7	15.2	13.0

Table III shows the totals of stationary motors reported by central electric stations divided between commercial and municipal stations. The totals were not reported for electric railways in the 1912 census, but are shown for these properties in 1907 and 1902. The same table gives the number of meters on consumption circuits and the number of customers reported by commercial and municipal central stations.

TABLE III—CENTRAL ELECTRIC STATIONS AND STATIONS OPERATED IN CONNECTION WITH ELECTRIC RAILWAYS—STATIONARY MOTORS AND TOTALS OF METERS AND CUSTOMERS

Class of Stations	Stationary Motors Served		Number of Meters on Consumption Circuits	Number of Customers
	Number	Horse-power		
Total, 1912	435,473	4,130,619	3,617,189	.....
1907	187,652	1,807,949	1,897,803	.....
1902	111,113	473,693	639,290	.....
Commercial, 1912	413,578	3,966,328	3,146,998	3,311,870
1907	162,677	1,617,337	1,468,763	1,663,354
1902	99,102	434,681	526,011	*
Municipal, 1912	21,895	164,291	470,191	525,648
1907	4,507	31,689	215,154	283,625
1902	1,962	3,324	56,678	*
Electric railways, 1912	*	*	*	.....
1907	20,468	158,923	213,886	.....
1902	10,049	35,688	56,601	.....

*Not reported.

Table IV gives statistics from electric railways and both classes of central electric stations, commercial and municipal, on rotary converters and motor-generator sets, boosters and transformers. Electric railways had 61.9 per cent of the total kilowatt rating of rotary converters and motor-generator sets in 1912 as compared with 72.2 per cent in 1907 and 48 per cent in 1902. Of the total kilowatt rating of these machines installed in central electric stations commercial plants had 98.8 per cent in 1912 and slightly larger percentages in the earlier years. The rating of the transformers increased 3,634,643 kw, or 128.6 per cent, from 1907 to 1912. From 1902 to 1907 the increase was 2,194,757 kw, or 347.3 per cent. The electric railways had 36.5 per cent of the aggregate kilowatt rating of transformers in 1912, as compared with 40.1 per cent in 1907 and 33.6 per cent in 1902. The commercial stations had 98.4 per cent of the kilowatt rating of transformers in 1912 and slightly larger percentages in the earlier years. The average rating of transformers for all stations increased from 183 kw in 1902 to 256 kw in 1907 and 290 kw in 1912. The average rating of transformers in central stations increased from 233 kw in 1902 to 296 kw in 1912. In commercial stations the increase was from 237 kw in 1902 to 311 kw in 1912. In municipal stations the increase was from 37 kw to 72 kw. The average rating of transformers reported by electric railways increased from 128 kw in 1902 to 279 kw in 1912.

The number and kilowatt rating of boosters increased from 1907 to 1912, although the figures in 1907 showed a decrease from 1902. The total rating of boosters was divided between central stations and electric railways in the proportion of, respectively, 47.9 per cent and 52.1 per cent. Statistics of boosters for 1907 and 1902 are probably incomplete because the schedules used in those years did not specifically ask for data on this item.

TABLE IV—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—SUBSIDIARY EQUIPMENT

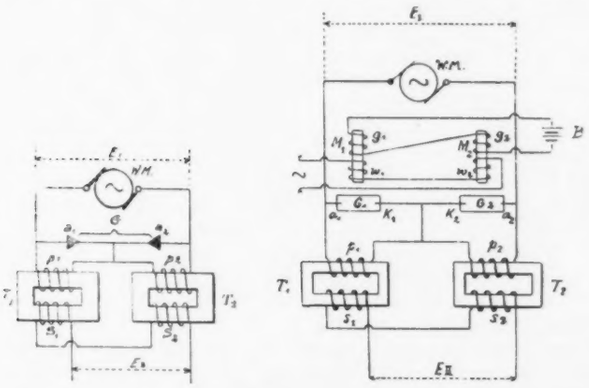
	Census	Rotary Converters and Motor-Generator Sets*		Boosters		Transformers	
		Number	Kilowatt Rating	Number	Kilowatt Rating	Number	Kilowatt Rating
Total	1912	4,667	2,646,396	511	47,628	22,304	6,461,336
	1907	2,532	1,305,651	261	21,856	11,062	2,826,693
	1902	742	333,426	297	31,577	3,457	631,936
Central stations	1912	1,827	1,009,136	328	22,821	13,868	4,103,939
Commercial	1912	1,781	996,531	295	20,151	12,972	4,039,236
Municipal	1912	46	12,605	33	2,670	896	64,703
Electric railways	1912	2,840	1,637,260	183	24,807	8,436	2,357,397

*Prior to 1912 motor generator sets were not included.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Frequency Changer.—J. JONAS.—The first part of an illustrated article in which the author first critically discusses the two principal methods now in use for producing high-frequency currents. He then describes a new method, the principle of which is indicated in Fig. 1. *WM* is an alternator, *G* a mercury-vapor rectifier with anodes a_1 and a_2 while the cathode is connected with the wire which joins the two primary windings p_1 and p_2 of the two transformers T_1 and T_2 in series, the secondaries of the transformers being connected in opposition. On account of the presence of the rectifier *G*, the magnetizing current does not pass uniformly through the two transformers T_1 and T_2, but for one-half period the transformer *T* is short-circuited by the rectifier, and the total emf is impressed on the transformer T_2, while for the next half period the situation is reversed. The emf E_2 has double the frequency of E_1. The ordinary mercury-vapor rectifier is not the most suitable apparatus for this purpose, but a new mercury-vapor rectifier with magnetically controlled arc is preferred. The arrangement is shown in Fig. 2. The article is to be concluded.—*Elek. u. Masch.* (Vienna), Jan. 10, 1915.



FIGS. 1 AND 2—ARRANGEMENTS FOR FREQUENCY CHANGER

Rotary Converter.—F. D. NEWBURY.—In a further instalment on the engineering evolution of electrical apparatus the history of the rotary converter in America is given with special reference to the work of the Westinghouse company in this field.—*Elec. Journal*, January, 1915.

The Shape of the Pressure Wave in Electrical Machinery.—S. P. SMITH AND R. S. H. BOULDING.—The first part of a mathematical article illustrated by numerous diagrams in which the emf induced in windings is determined analytically and the effect of flux-swinging is investigated. The importance of the winding factor is emphasized. The subject is discussed from the point of view of classification of windings, flux distribution, effect of slots and effect of flux pulsations.—London *Electrician*, Jan. 15, 1915.

Magnetization Curves.—JOHN D. BALL.—Three brief notes on magnetization curves. For designing machines and for various other purposes it is often necessary to know the value of magnetization for higher inductions than are usually given by test. But care must be taken in extrapolation, since in extrapolations of magnetization curves the equation $B = \frac{H}{a + sH}$ introduces large errors. It is necessary to use $B = \frac{H}{a_0 + s_0 H} + H$ or some other form that provides for the metallic density to which the *H* values are added. The second note relates to the so-called knee of the magnetizing curve, and it is pointed out that the knee is not entirely a magnetic phenomenon but is largely a function of the scale selected to represent the magnetizing forces. In the third note the advantages of plotting magnetization curves on logarithmic paper are pointed out.—*Gen. Elec. Review*, January, 1915.

Heating Curve of Electrical Machines and Transformers.—ARTHUR MUELLER.—A description of a method which permits one to find from two single measurements the final excess of temperature which an electric machine will assume when the temperature becomes constant. The method permits of saving a great deal of time. The fundamental feature of the method is that the excess of the temperature of the machine (over the temperature which the machine has when unloaded) is measured first at a certain time after the machine has been inserted in circuit and again after an elapse of exactly the same period of time. If the time is measured from the moment when the machine is connected to the circuit, the first measurement may be made after x hours; the second measurement must then be made after $2x$ hours. If the first measurement gives a temperature of y and the second measurement a temperature of y_1 deg., the excess temperature *T* which the machine will assume when the temperature becomes stationary will be $T = \frac{y^2}{2y - y_1}$. If, for instance, the excess temperature measured after three hours is $y = 53$ deg. C. and after six hours is $y_1 = 78$ deg. C., the final excess temperature will be $53^2 \div (106 - 78) = 100$ deg. C., as indicated in Fig. 3. Of course, a sufficient length of

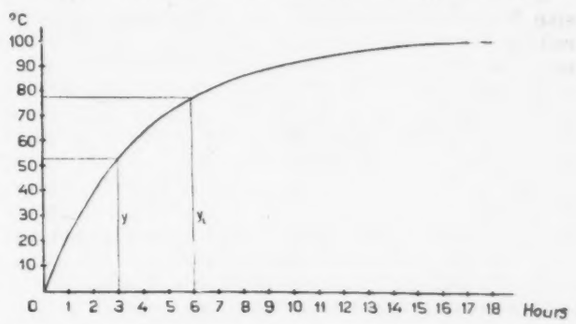


FIG. 3—TEMPERATURE CURVE OF ELECTRIC MACHINE

time must be allowed until the first measurement is made; if it is made shortly after the machine is connected to the circuit, there is a liability of error.—*Elek. u. Masch.* (Vienna), Jan. 10, 1915.

Lamps and Lighting

Tungsten-Filament Lamps for Heterochromatic Photometry.—G. W. MIDDLEKAUFF AND J. F. SKOGLAND.—The results found in this investigation show that for 100-volt to 130-volt vacuum tungsten lamps of the ordinary sizes an equation of the form $y_n = A_n X^2 + B_n X + C$ expresses the voltage candle-power and the voltage watt-per-candle relations to well within 0.3 per cent and the voltage-wattage relation to well within 0.05 per cent of the observed values over the whole range investigated, namely, from 0.7 watt per candle to 3.3 watts per candle, the latter limit extending somewhat beyond the watt per candle corresponding to color match with 4-watt-per-candle carbon lamps. It is, therefore, possible, after carefully standardizing a tung-

sten lamp at color match with the 4-watt-per-candle carbon primary standards which maintain the international candle unit, to calculate with a high degree of precision its candle-power, voltage and current at any desired watt per candle (or color) within the range mentioned. In this manner groups of standards at different values of watt per candle may be established in terms of the primary standards without making a single measurement with a color difference. Further, any standardized tungsten lamp of the size and voltage investigated is virtually a standard for use at any watt per candle (or color) within the range specified, because its candle-power and current at that color can be completely determined from a knowledge of the corresponding observed voltage. By this method of standardizing lamps all measurements are made at color match without the use of color screens, which may be entirely discarded except in so far as they may be of use as auxiliaries in making check measurements. A set of tables of the characteristic relations is appended.—*Scientific Papers*, Bureau of Standards, No. 238 (Oct. 10, 1914).

Traction

Electric Locomotive.—E. E. SEEFEHLNER.—An article giving in a table data and figures of equipment of various electric trunk railway locomotives and discussing the effect of different mechanical and electrical factors on the weight of the locomotive.—*Elek. u. Masch.* (Vienna), Jan. 3, 1915.

Car Equipment.—S. B. COOPER.—An article illustrated by diagrams and tables on the calculation of the characteristics and capacity required in a motor equipment to perform a given service.—*Elec. Journal*, February, 1915.

Installations, Systems and Appliances

Charges for Energy Sold from Railway Power Plant to Private Consumers.—BRUNO THIERBACH.—The Prussian Railway Department, which operates the electric railway between Magdeburg, Leipzig and Halle, has announced its desire to sell yearly 30,000,000 kw-hr. of single-phase energy at 60,000 volts and sixteen and two-third cycles per second under favorable terms to private consumers. There are two entirely different rates, depending on whether a consumer wants to be able to take energy at any time he pleases or is willing to agree in advance that he will not take energy at certain hours. In the first case, in which there is no restriction as to hours of energy consumption, a double rate is employed with unit charges of 0.6 cent per kw-hr. for the fifteen and one-half hours from 6.30 a. m. to 10 p. m. and 0.4 cent per kw-hr. for the eight and one-half night hours from 10 p. m. to 6.30 a. m. The average cost of the kilowatt-hour, therefore, does not depend on the total quantity of energy but on the ratio of the kilowatt-hours consumed during the expensive day hours to the kilowatt-hours consumed during the cheap night hours. If this ratio is 0.5, the average cost of the kilowatt-hours is 0.4675 cent. If the ratio is 3, the cost is 0.55 cent. With an absolutely uniform load curve over the whole twenty-four hours, the cost is 0.53 cent. On these prices, however, a discount is allowed. Every consumer has to agree in advance, first that he will consume a certain minimum amount of kilowatt-hours per year and, second, that he will never consume more than a certain maximum amount (say Z) of kilowatt-amperes. To insure the latter condition an automatic power-limiting device is provided. If the total consumption in the year is L kw-hr. (greater than the agreed minimum amount), the discount paid back to the consumer at the end of the year is $\frac{25\,L}{8760\,Z}$ per cent. The amount depends on L/Z (the ratio of kilowatt-hours to maximum kilovolt-amperes) and not on the amount of energy. As the year has 8760 hours, L/Z cannot be greater than 8760 and the discount cannot be more than 25 per cent. It is 2.85 per cent for $L/Z = 1000$, 11.4 per cent for $L/Z = 4000$, and 22.8 per cent for $L/Z = 8000$. In the second kind of schedule the department is willing to allow still lower rates if the customer agrees not to use energy for certain hours. Again, a double rate will be made, the specifications being as follows: "First, energy is furnished from 10 p. m. to 6 a. m. with an exception of a total of —— hours. Second, energy is furnished from 10 p. m. to 6 a. m. with an exception of a total of —— hours." Special agreements as to unit prices, hours of exception, etc., are to be made for each case. The prices will be lower than with the first schedule and may vary between 0.325 cent and 0.475 cent per kw-hr. Such prices have not been known before in Germany. It is thought the chemical industry should be particularly attracted and benefited by this cheap energy.—*Elek. Kraft. u. Bahnen*, Jan. 4, 1915.

Electrification of Flour Mills.—ERNEST P. HOLLIS—An article discussing the various operations in a flour mill, analyzing critically the objections which are usually raised against their electrification, and explaining the advantages of such an electrification.—London *Elec. Review*, Jan. 22, 1915.

Wires, Wiring and Conduits

Temperature Rise in Twin Flexible Wires.—S. W. MELSOM AND H. C. BOOTH.—An abstract of a paper, based on a report of the (British) National Physical Laboratory to the wiring rules committee of the British Institution of Electrical Engineers. The authors deal with the temperature rise in flexible wires, (a) due to the current passing through them, (b) due to heating from a pendent lamp, (c) when used for connection to electrical heating apparatus.—London *Electrician*, Jan. 22, 1915.

Electrophysics and Magnetism

Wehnelt Cathode.—FRANK HORTON.—An account of an experimental investigation of the action of a Wehnelt cathode—that is, of the large electron emission which takes place when a lime-coated cathode is heated in a vacuum. The author gives a comparison of the electron emission from lime heated upon a Nernst filament with that from lime heated upon platinum and then discusses the liberation of gas from a Wehnelt cathode. The chief results are as follows: The electron emission from a Wehnelt cathode has its origin in the lime itself, and the lime does not merely serve to help the electrons to escape from the metal. When an electric current passes through lime at a high temperature the amount of oxygen liberated is only a very small fraction of what would be expected if the conductivity of the lime were entirely electrolytic. It has been suggested that the conductivity is entirely electrolytic, and that the products of electrolysis diffuse through the lime and recombine; but it appears to the author to be improbable that such recombination should go on, so rapidly and completely, through a layer of solid lime, especially as the charged oxygen atoms would be liberated on the vacuum side of the oxide layer and with a strong electric field tending to drag them away from the cathode. The chemical combination of calcium and oxygen does not by itself give rise to any detectable electron emission.—London *Electrician*, Jan. 1, 1915.

Electrochemistry and Batteries

Automobile Batteries.—R. T. MITCHELL.—An abstract of a paper read before the (British) Association of Engineers in Charge on electric storage batteries

and their application to automobile traction, with special reference to the Edison battery. A comparison between the lead cell and the Edison cell was given in calculated form, and it was stated that Edison cells are good for over 3500 cycles of charge and discharge. Taking a mileage of 50 per discharge, this would mean a distance of 175,000 miles of effective service per battery.—London *Electrician*, Jan. 22, 1915.

Fixation of Atmospheric Nitrogen.—E. WEINWURM.—The author describes the making of nitric acid and nitrates from air by the processes of Birkeland and Eyde, Schoenherr and Pauling; also the production of ammonia and pure alumina by the Serpek process and the ammonia synthetic process of Haber, and finally the calcium - cyanide industry.—*Elek. u. Masch.* (Vienna), Jan. 3, 1915.

Electric Steel Furnace.—G. MUNTZ.—An article in reply to a former one by Rennerfelt. The author endeavors to show that the electric furnace for steel castings has certain commercial limitations and tries to make out a case for the small converter.—*Met. and Chem. Eng'ing*, February, 1915.

Units, Measurements and Instruments

Inductive Rheostat.—F. ANDRÉ.—If in any ordinary rheostat the non-inductive ohmic resistance coils are replaced by inductive resistance or reactance coils and the handle of the rheostat is turned from one position to the next, the current assumes its new value with greater rapidity than in the case of purely ohmic resistance. Fig. 4 shows the connections of this method for the

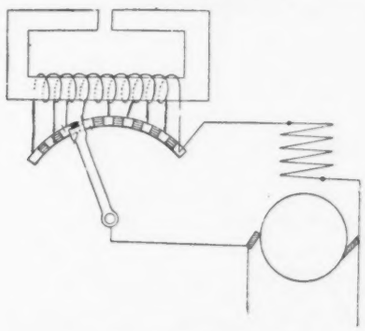


FIG. 4—WIRING DIAGRAM

regulation of the shunt excitation current of a generator. The excitation winding is in series with a rheostat, consisting of a number of reactance coils, all wound in series around the same iron core with an air gap so as to have practically constant permeability. The handle of the rheostat makes connection with the successive knobs. The author goes on to discuss the problem of dimensioning the different portions of the rheostat coils and discusses the two cases depending on whether the handle is turned to one or the other direction. The conditions are not the same in both cases. The conclusion of the author is that this method permits one to reach the desired current by turning the rheostat handle much more quickly than is possible with the ordinary rheostat form of pure ohmic resistance. With respect to the dimensions of the different portions of the rheostat, the most convenient solution is that in which the potential energy of the circuit always has the same value whatever may be the position of the regulator. The mathematics of the problem is given.—*La Revue Elec.*, Vol. 22, No. 259, "Oct. 2, 1914 (published Jan. 1, 1915)."

Telegraphy, Telephony and Signals

Telegraph Repeaters.—A. C. BOOTH.—An article on the British post office type of telegraph repeaters and some recent modifications made to meet the requirements in connection with the introduction of the Baudot duplex on the Anglo-German cable circuits and the extended application of high-speed apparatus to the long underground cable circuit between important centers.—*Post Office Elec. Eng. Journal* (London), January, 1915.

Telegraph Relays.—H. W. MALCOLM.—In a continuation of his long illustrated serial on the future progress

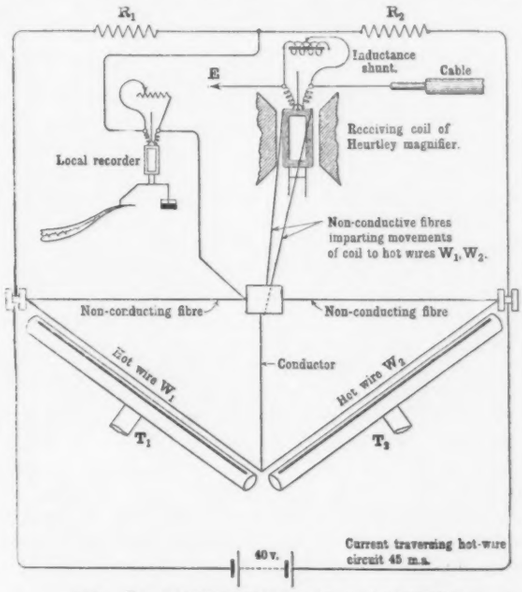


FIG. 5—CONNECTIONS OF MAGNIFIER

of cable telegraphy, the author deals with relays of Heurtley and Orling. In the magnifier invented by Mr. E. S. Heurtley, shown in Fig. 5, the motion of the receiving coil is communicated through silk fibers to an aluminum cradle. This cradle carries two fine platinum wires (0.5 mil in diameter), which are heated by current from a local battery and from two arms of a Wheatstone bridge. The tubes T_1 and T_2 communicate with some source of cold air; they are slit down their entire length where they are adjacent to the wires W_1 and W_2. The positions of the tube slits are so adjusted that a deflection of the coil in one direction brings W_1 into the cold blast, W_2 remaining out of the cold blast—

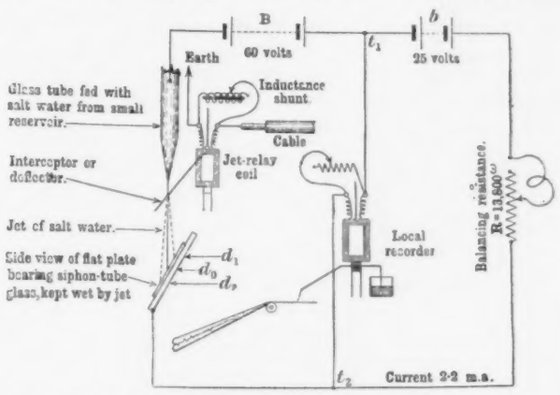


FIG. 6—VARYING-RESISTANCE TYPE OF JET RELAY

that is, remaining hot—while a deflection in the opposite direction brings W_2 into the cold blast, W_1 remaining out. In this manner reversal currents received from the cable are caused to alter the bridge balance in one direction or the other, thereby producing reversal signals on the local recorder. Similar results may be obtained by the coil being caused to move

screens over one slit or the other. To compensate for the time-lag in the heating and cooling of the wires, inductances—or capacities—may be inserted in the bridge arms to square up the signals. This instrument is said to be capable of receiving at the rate of seventy-five words a minute with an actuating current of 0.7 mfd. It is in use continuously on the long cables of no fewer than five companies. In the magnifier invented by Axel Orling the receiving coil is caused to deflect a jet of water, through the instrumentality of a quartz fiber. In the latest form of this instrument, shown in Fig. 6, the jet of conducting water impinges on an inclined plane which carries a number of fine glass tubes. In series with the jet is a local battery, and the current from it through the local recorder is balanced by a second, smaller battery through a resistor of adjustable resistance. Alternatively a second winding may be used on the recorder coil. When the jet is moved by the quartz fiber from its normal position d_0 to make contact with the inclined plate d_1, the length of the jet is reduced and its resistance decreases; when the jet is moved to d the resistance increases. The current fluctuations produced by these changes of resistance actuate the local recorder. It is a peculiar and characteristic property of the instrument that a microscopic deflection of the coil and quartz fiber suffices to produce a large deflection of the jet. The sensitivity of the instrument may be varied in different ways. Thus, conveniently, the angle of incidence of the jet on the plate may be adjusted by altering the angle of inclination of the plate to the vertical. Again, a fixed deflector may be placed between the moving deflector and the plate, and this process may be repeated without limit and without the moving coil being called upon to perform any extra work. The instrument may obviously be used as a make-and-break relay, in which all contact trouble has been eliminated. Employed in this way it is stated to require a current of only 0.01 microampere to give good signals. A modified form of this relay is also described.—London *Electrician*, Jan. 22, 1915.

Quadruplex.—J. M. Fernandez Lamothe.—An illustrated article pointing out the advantages in efficiency of the American quadruplex system over the British. He shows that the arrangement in itself is more effective in correcting the breaking of signals and permits quadruplex working on longer lines, other conditions being equal.—*Post Office Elec. Eng. Journal* (London), January, 1915.

Long-Distance Telephony.—J. A. Fleming.—An abstract of a lecture before the Royal Institution in London in which the author described the cord-vibrating apparatus and experiments demonstrating wave propagation over unloaded and loaded lines. By his apparatus he demonstrated the correct spacing of loading coals and also gave an illustration of reflection.—*Post Office Elec. Eng. Journal* (London), January, 1915.

Miscellaneous

Edward Weston.—An account, with portrait, of the presentation of the Perkin Medal by the allied chemical societies of this country to Dr. Edward Weston. The speeches by C. F. Chandler, L. H. Baekeland and Carl Hering are given almost in full and an account is given of Weston's reply.—*Met. and Chem. Eng'ing*, February, 1915.

War and Engineering.—Marquis of Graham.—His presidential address to the Junior Institution of Engineers. He pointed out that war has become largely a matter of engineering, especially with respect to transportation. The motor tractor has solved some problems. Enormous efforts had been made by the textile industries to provide clothes for large armies.—London *Electrician*, Jan. 22, 1915.

Book Reviews

The Elements of Electricity. By Wirt Robinson. New York: John Wiley & Sons, Inc. 596 pages, 373 illus. Price, $2.50.

This textbook has been prepared for the use of the cadets of the United States Military Academy at West Point. The present volume, the second edition of this work, consists of forty-seven chapters under six main headings, as follows: Static electricity, magnetism, voltaic electricity, electromagnetics, electromechanics, and high potentials. The treatment is simple and clear, and the illustrations are numerous, these being indeed worthy of special praise. Halftone photographic reproductions are avoided, and simple line drawings, admirably adapted to illustrate the essential points of the apparatus described, have been specially prepared. The necessary diagrams have also been very carefully drawn to avoid the confusion so often caused by unnecessary lines and figures. Although this may be considered an elementary text, it covers the whole field of electricity and magnetism very completely, giving the student a general yet correct understanding of the subject. The point of view is that of the physicist rather than that of the engineer, as it should be in a work designed to give the student a broad view of the whole subject which may serve him as a sound and correct basis for more advanced study. The author has obviously taken pains to produce a really useful text, which, mainly on account of the arrangement of the subject and the clearness of the presentation, is better than a mere compilation of previously published matter. Students of the art of electricity will, in the reviewer's opinion, find this a helpful and interesting textbook.

Electric Motors, Their Action, Control and Application. By Dr. Francis B. Crocker and Morton Arendt. New York: D. Van Nostrand Company. 306 pages, 169 illus. Price, $2.50.

This is the second edition—revised and enlarged—of Professors Crocker and Arendt's well-known book. It is more advanced and more scientific than the type of book intended to give advice and assistance to those responsible for the proper running of electrical machinery. It goes down to fundamental principles and explains clearly the reasons of things, making use, wherever necessary, of arguments and methods which would not be readily understood except by engineering students or trained engineers. Matters of only theoretical or special interest have been deliberately omitted, and the authors have confined themselves strictly to their subject, giving the reader what they profess to give in an attractive and interesting manner. Those who wish to pursue the subject further or to branch out in lines of study allied to the matter here treated will find useful lists of reference at the end of each chapter. The bibliography relating to electric machine design at the end of Chapter II is not complete. This list might with advantage be enlarged, or—what in the reviewer's opinion is generally preferable—reduced to cover only those publications which are approved by the authors and in which the manner of presentation and treatment is generally similar to theirs. The most important subject covered is that of speed control, and this matter is admirably presented. The different methods of obtaining speed variation with any kind of motor are studied and the underlying principles explained. Part IV, which treats of the application of electric motors, under the headings "Service Conditions" and "Power Requirements of Various Tools," is a practical and useful feature of the book.

POWER AND OPERATING SECTION

Training the Operating Force

AN analysis of operating records shows that very many interruptions to service and accidents to machinery and equipment are attributable to defects in organization. Duplication in generating equipment, feeders, etc., is of no effect if the operating force is not properly trained in handling the apparatus. With consolidations of properties and extensions to distribution systems operating complications grow and liability to mistakes increases. Moreover, accidents due to mistakes of the operating force become more costly with increase in the size of equipment or load. What is needed to meet such emergencies is a staff trained with all the precision of a military organization, but with greater resourcefulness. Excellence in operation must keep pace with excellence of equipment, and the necessity for constant service is so great that the selection, organization and training of an efficient operating staff transcends in importance oftentimes the purely engineering problems involved in the design of the system.

Increase in Stationary-Motor Service

WHEN it is learned from the census returns that the average number of stationary motors per central electrical station in 1912 was eighty-three the impression made is encouraging if viewed from the standpoint of the small station; it may be dispiriting if, from the outlook of the large station, we compare the business secured with the large volume awaiting. Another side is presented by comparison of the average for 1912 with that for 1907 of thirty-five, and that for 1902 of twenty-eight. The increase from 1902 to 1907 was 25 per cent; from 1907 to 1912 it was 137 per cent. It is proper to say that another large increase will be shown in the next census report, but the really vital question is whether the enlargement of business in this direction will prove that central stations have made the most of their opportunities. The extent of the field now occupied and the progress in the last census period of five years are an example of what can be done in the future with study of new methods of motor application.

Safety and Service

WITHOUT attempting to belittle the nation-wide movement to reduce the number of preventable accidents, Mr. W. H. Blood, Jr., insurance expert of the National Electric Light Association, rightly contends that, in the electrical industry at least, service of necessity is the more important. Reasonable safety is attainable without impairing service, but absolute safety is impossible. Zealots of the "safety first" movement should ponder Mr. Blood's remarks, published in abstract elsewhere in this issue, because it is so easy for them to defeat the very object they seek by overworking the principle. No device however perfect can take the place of vigilance, and both combined render safety only reasonably sure. The success that has attended the installation of safety devices in many industries is due primarily to the fact that their use has permitted increased service or economies. Our industry is not lacking in these, and if attention can be directed toward improving construction and apparatus to safeguard life the gain will be immense. Rather a thousand times a motor-operated oil switch than a knife-blade switch with a railing around it and an insulated platform on which to stand.

Advantages of Electric Motor Drive

IN the movement toward greater economy in industrial operations the electric motor plays an indispensable part. Production can be increased greatly by its use, not only by reason of better and more constant speed, but also because the expert workman, relieved of worry and physical exertion incident to other forms of drive, can concentrate all his energy and ability on the task before him. Besides the advantages which are inherent in the electric motor itself, there are other desirable features oftentimes overlooked of more convenient and responsive control, which in some instances is so skilfully applied as to render the machine almost human in its operation. Convenience is the great asset of electricity, and while that fact is recognized in the case of lighting, it is not always accentuated when applying motors to industrial uses.

The Diesel Oil Engine

IN his article in this issue Mr. R. W. Crowly throws much light on some of the causes which have checked the adoption of the Diesel oil engine in this country. They are causes, too, which have been noteworthy in connection with the introduction of not a few European devices into American practice. In principle an internal-combustion engine using heavy oil should naturally thrive in a great oil-producing country like the United States, just as it has in Russia. As a matter of fact, despite its notable lack of skilled labor, the latter country has gone ahead in oil-engine work at a rather remarkable pace. Mr. Crowly notes that at the present time Diesel engines in use over the world have an aggregate rating of more than 2,000,000 hp. One is justified in stating broadly that a prime mover which has pushed its way against the competition of others into use to this extent is very far past the experimental

stage and must be taken seriously. The principal objection urged against it in this country is that it is expensive in first cost and somewhat "tender" in operation. The pressures are high, the temperatures exceptionally great, and the need for exact fitting and thorough lubrication very pressing. It still has its way to make in this country, and its success, as Mr. Crowly shows, depends chiefly on the care with which it is manufactured and the intelligence with which it is exploited. Prime movers of moderate size and high economy are badly needed, and if the oil engine displays the virtues here which it is reputed to have in Russia, for example, the next census of motive power should show a substantial addition attributable to American activity.

Conserving the Coal Supply

In a paper read before the Newcastle Section of the (British) Institution of Electrical Engineers, Mr. P. S. Thompson brought forward a considerable amount of useful information about the theory of boiler operation, but its chief interest to the engineer resides in some of the collateral suggestions both in the paper and in the discussion following its presentation. As regards the ordinary lines of steam practice, perhaps the most noteworthy feature of the paper was its outspoken advocacy of forced draft in burning the ordinary grades of bituminous coal. The author of the paper, abstracted in this issue, mentions the somewhat familiar but often forgotten fact that from 10 to 12 per cent of the energy of the fuel is consumed merely to secure the necessary draft for free combustion by maintaining the requisite difference in temperature between the flue and the exterior air. Moreover, one must reckon on the added fixed charges due to the building of an expensive stack. In these days, when boilers must often be forced to meet the requirements of economy in central-station operation, it would seem that during some parts of the run a draft created by motor-driven blowers would be more economical than natural draft. At least the chance of economy by this method is sufficiently great to encourage following it up, especially in parts of the country where it is most economical to use a relatively poor grade of fuel. A forced-draft system can be easily adjusted to meet the requirements of economical firing with almost any grade of fuel consumed at almost any possible rate, while the natural draft must in a measure be planned to meet the average requirements.

More far-reaching than this discussion of draft, however, was the consideration of the use of coal indirectly through coking or producer-gas operation. In the discussion it was pointed out that by coking at a low temperature there is presented the opportunity for obtaining electrical energy as a by-product among other valuable material. For instance, according to the figures reported, one ton of ordinary bituminous coal will yield about 0.75 ton of coke, 3.5 gal. of motor spirit, 9.5 gal. of heavier oils, 20 lb. of pitch, 24 lb. of ammonium sulphate and other by-products in smaller quantities, the total value of which at current prices amounts to about $7.75 for about $5 of operating and fixed charges. Over and above the products mentioned, about 5000 cu. ft. of gas would be generated, of quality sufficient to give at least 100 kw-hr. of electrical energy as an additional by-product. Such a utilization of fuel looks promising, particularly since such of the coke as seemed worth while could be used for generating additional electrical energy by steam.

The Locomobile in America

We have repeatedly called attention to the very interesting "locomobile" type of prime mover, which has met with great success abroad. Fundamentally, as our readers know, it is simply a self-contained boiler and engine equipment in which all the heat losses are cut down to a minimum by the compact construction, with high steam pressure and high superheat, and also the gains in economy that scientifically designed valve gear and good condensing equipment can give. The performances of these small equipments abroad have been little less than astounding, and we have hoped to see them introduced in sufficient numbers in this country to allow a practical judgment to be formed of their success under American conditions. At least two experienced manufacturers in this country have undertaken the construction of locomobiles following somewhat closely after the foreign models. From the information conveyed in an article published in the current issue only one of the eight locomobile units to-day in use in this country is of foreign manufacture, and the aggregate rating of the whole group is considerably less than 2000 hp.

We take pleasure in presenting in this issue data relating to fuel consumption tests on two 150-kw locomobile plants which have recently been put in service. Each is a single unit of a separate 300-kw plant. The economy of space secured by the locomobile equipment is notably great since each unit with its generator occupies an area of barely 500 sq. ft., and the whole power plant can therefore be made extremely compact. The steam pressure in each case is about 225 lb. and the superheat about 200 deg. The engines run at approximately 200 r.p.m., giving about 250 indicated horsepower. The fuel consumption per kilowatt-hour in each case was very close to 3 lb. of not very good run-of-mine coal. It is greatly to be regretted that the figures reported do not include the consumption of steam either per kilowatt-hour or per brake-horse-power-hour, to enable proper comparison to be made between the performance of these particular engines and that of their German prototype. In the case of the latter a consumption of 10 lb. of steam per brake-horse-power-hour under test is a guarantee not uncommonly fulfilled under suitable conditions of condensation. The war, suspending as it has most importations from abroad, should give the American manufacturers of such machinery a clear field with every encouragement to exploit a type of unit which has already proved its usefulness and which has had successful tests in practical operation.

Two American-Built Locomobile Power Plants

Test Data on the Performance of Two 150-kw Units Showing Consistent and Remarkably Low Specific Consumption of Fuel

RECORDS of 3.03 lb. of fuel per kilowatt-hour at the switchboard were shown in the acceptance tests made upon two new 150-kw locomobile power plants recently completed in Ohio. The forked run-of-mine coal used as fuel in both cases tested 10,555 pound-Fahrenheit heat units per pound in one instance, and 11,416 units per pound in the other. The plants referred to are owned respectively by the O. C. Barber Mining & Fertilizer Company of Canton, Ohio, and by the Barber Concrete Products Company of Barberton, Ohio. Situated at Limeton, Ohio, about 8 miles south of Canton, the station of the first-mentioned company occupies a central site on the company's 5000-acre tract of mineral-bearing land. The second plant is situated in the outskirts of Barberton.

At Limeton, on the property of the mining and fertilizer company, there are three valuable mineral strata, namely, coal, limestone and fireclay. Of these three the coal forms the middle stratum, with the limestone above and the fireclay beneath. The business of the mining and fertilizer company is to bring out the middle stratum, the coal, for producing power and for the market; then to cut down and remove the limestone for conversion into lime, and lastly to remove the fireclay. The many grinding and conveying operations necessary in this industry are performed in two mills receiving power from the Limeton station. The connected load at the two mills is about 700 hp.

Energy generated in the Barberton plant is used to drive the machinery in the concrete-products factory and also will be used to operate the extensive electrical equipment at the Anne Dean farm, the home of Mr. O. C. Barber.

The Power House Is a Comparatively Small Building

These two stations are very similar in design, and the equipment which they contain is of identical rating. A drawing reproduced in Fig. 8 shows a plan and a sectional view of the 50-ft. by 60-ft. by 16-ft. concrete-block power house at Limeton, containing two 150-kw, 440-volt, three-phase Crocker-Wheeler generators, each driven by a locomobile made by the Buckeye Engine Company. The floor space of the combined engine and boiler room in which these two self-contained power plants are installed measures only 38 ft. by 57 ft., and even then there is plenty of vacant space around the walls, for each prime mover with its generator occupies a space only 24 ft. 11 in. in length by 20 ft. in width by 12 ft. 4 in. in height. The remainder of the building is taken up by the 48-ft. by 8-ft. coal-storage room, an office for the engineer and a small machine shop. In laying out the openings in the walls of the building, doors were placed opposite each end of the locomobiles and thus some floor space was saved, since in installing or removing the boiler tubes or the superheater and reheater tubes the doors can be opened to provide sufficient end clearance for the operation.

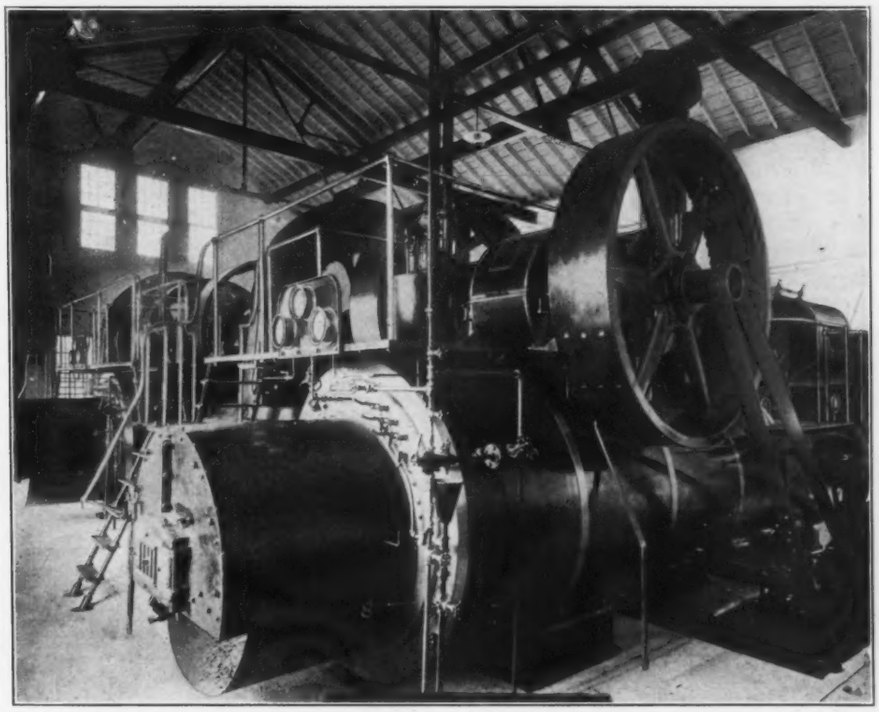


FIG. 1—300-KW LOCOMOBILE POWER STATION AT BARBERTON

Coal Slides from the Mine to the Firebox

At Limeton the problem of supplying coal to the station is an easy one. The fuel is simply dug out of the hill back of the power house and dumped into a chute, through which it slides into the long narrow concrete storage room. To prevent dribbling the coal over the engine-room floor sheet-iron hoppers on low wheels are used to bring the fuel from the storage room to the firing doors. Each of these wheeled hoppers holds about

1000 lb. of fuel, and their use eliminates the necessity of heating coal before the firing door as is sometimes the practice in stations with hand-fired boilers. As the ashes drop or are shaken through the grates they fall into the suspended sheet-iron ashpan, from which they are shoveled into a wheelbarrow and hauled to the dump. Water is also near at hand, and a supply of

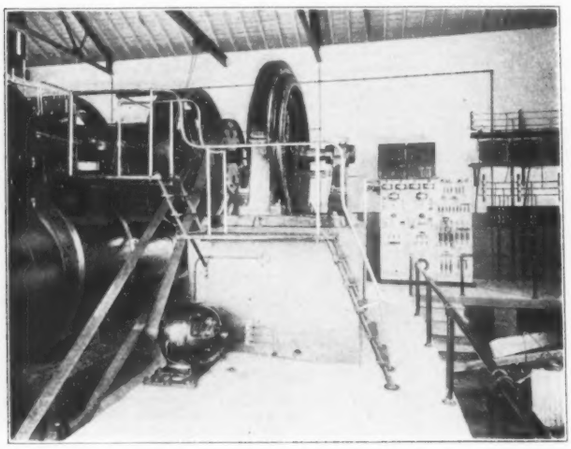


FIG. 2—FLEXIBLE COUPLING ACTS AS PULLEY

boiler-feed water and of water for the condensers is taken from the small stream which runs within a few yards of the station and is pumped into a tank supported on an iron framework in the power house near the peak of the roof.

Since there are but eight locomobile installations in the United States, a brief description of one of these Buckeye-mobiles, as they are called, may be of interest and may lead to a clearer understanding of the accompanying acceptance-test data.

Interesting Details of the American-Built Locomobile

The Buckeye-mobile is a self-contained power plant designed for the effective utilization of high-pressure superheated steam. In its elements it consists of an

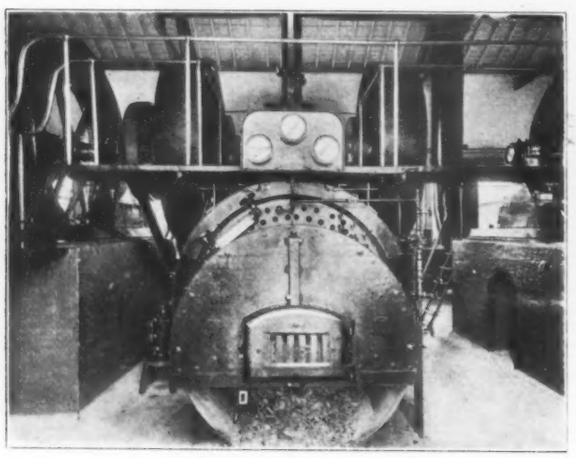


FIG. 3—FURNACE AND ASHPAN

internally fired tubular boiler of the non-return or "gunboat" type, on which is mounted a compound engine. An insulated sheet-metal smoke box incloses the tubular superheater, both engine cylinders, all steam piping and valves, and a secondary superheater which imparts heat to the steam as it passes from the high-pressure to the low-pressure cylinder.

The boiler is of the internal corrugated-furnace fire-tube type. The furnace, tubes and tube sheets constitute the entire active heating surface; therefore any possible deterioration and need of repairs is confined to these parts which are attached to the boiler shell by studs and nuts, making them readily removable for

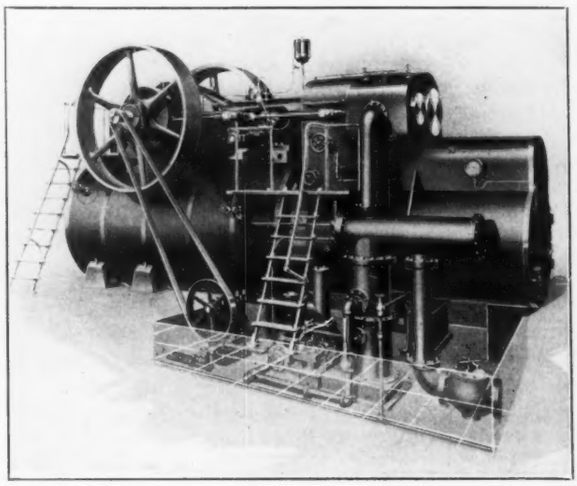


FIG. 4—ARRANGEMENT OF AUXILIARY APPARATUS

inspection and cleaning. Boilers of this type, it is said, suffer less from mineral and other harmful substances in the feed water than any other type, since sediment collects in the bottom of the boiler, which is the coolest part, and can be readily blown off before it has been baked hard. The boiler, with its equipment of gages, valves, etc., is built to conform to both state and city laws, 225-lb. steam pressure being carried. Induced draft for the furnaces is supplied by a fan driven by a 5-hp motor. The arrangement of "underground" breeching, the draft fan, stack and fan motor are shown in Fig. 5. Fig. 7 illustrates the arrangement of furnace and grate for high-grade, low-volatility coals. For high-volatility coals and low-grade fuels requiring an increased grate area furnaces of the extended type

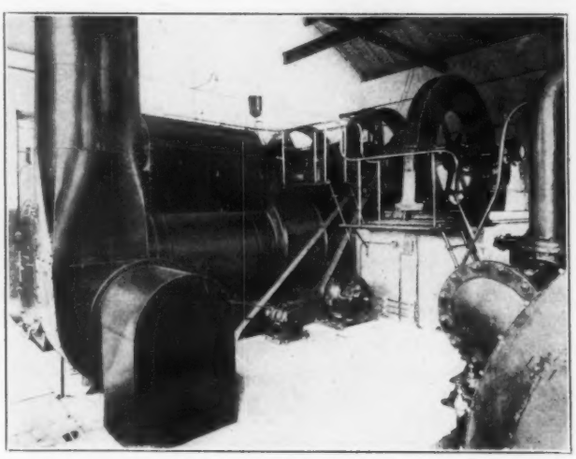
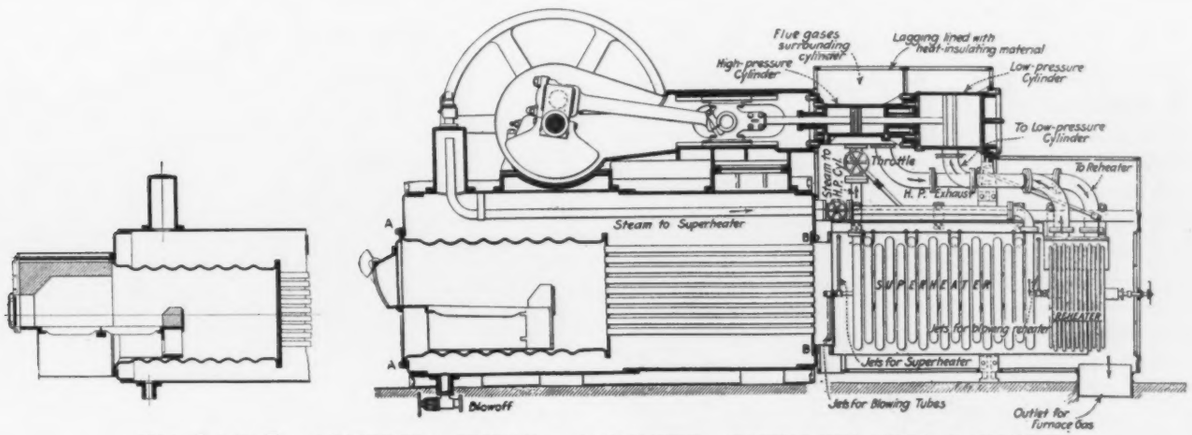


FIG. 5—UNDERGROUND BREECHING AND DRAFT APPARATUS

shown in the illustrations are used. A single continuous coil of seamless steel tubing comprises the initial superheater. The steam passes through it in a direction counter to that of the hot gases. On its way from the high-pressure to the low-pressure cylinder the steam passes through a secondary superheater or single-pass reheater built up of a large number of small tubes ex-

panded into headers. Both the superheater and the reheater are suspended from rollers on an overhead track which allows freedom for expansion of piping and also affords an easy means of removal from the smoke box should occasion require it. Provision is made for the barring gear provided to facilitate turning the engine by hand. The flywheels are notched on one edge so that the point of a crowbar may be inserted at any point on the circumference.

The engine exhausts through a closed feed-water



FIGS. 6 AND 7—LONGITUDINAL SECTION OF LOCOMOTIVE, SHOWING TWO TYPES OF FURNACE

cleaning the soot and dust from the tubes of the boiler, superheater and reheater by the installation of a steam-jet soot blower. Superheated steam is used and the jets may be revolved at will by means of the hand-wheel which is shown at the end of the boiler.

TABLE I—PLANT DATA AND RESULTS OF TEST*

	Barberton Plant	Limeton Plant
Grate surface of boiler, square feet	13.5	13.5
Heating surface of boiler (approximately), square feet	480.0	480.0
Ratio of grate surface to heating surface	1 to 35.6	1 to 35.6
Superheating surface (approximately), square feet	336.0	336.0
Reheating surface (approximately), square feet	140.0	140.0
Rated horse-power of engine	225.0	225.0
Duration of trial in hours	8.0	9.0

*Size of engine, 10 in. by 20 in. by 21 in.

Engine Mounted on Top of the Boiler

The engine is of the compound center-crank type. Its bedplate is rigidly bolted at its main bearing end to a massive saddle which spans about one-third of the boiler's circumference. The guide-barrel end rests on a smaller saddle and is free to slide thereon, relieving the bedplate from the effects of boiler expansion. Each cylinder is equipped with a single piston valve. The low-pressure valve is opened by a fixed eccentric, and the engine is governed through the high-pressure valve only. One of the unusual features of the engine is

TABLE II—AVERAGE PRESSURES

	Barberton Plant	Limeton Plant
Steam pressure, pounds per square inch, gage	214.60	219.0
Receiver pressure, pounds per square inch gage	19.0	20.0
Draft in furnace, inches of water	0.28	0.31
Draft in breeching, inches of water	0.70	0.60
Vacuum, inches of mercury referred to 30-in. barometer	25.50	25.00

heater into a 16-in. Connorsville jet condenser, which is provided with a 6-in. by 6-in. rotary air pump. This air pump and the 2-in. by 3-in. Demming triplex boiler-feed pump are installed in the shallow condenser pit. The former is driven from the engine half of the flexible coupling between the prime mover and its generator. Thus the coupling serves as a pulley and at the same time insures that the condenser pump will always start with the engine. The boiler-feed pump is belted to the engine shaft.

Connected to each locomobile in these two plants is a 150-kw, 440-volt, three-phase engine-type Crocker-Wheeler alternator. A flexible shaft coupling interposed between the engine and the generator relieves the generator bearing from the effects of boiler expansion. Belts for both the condenser pump and the exciter are driven from this coupling, conserving pulley space and reducing the necessary length of the shaft. The pump

TABLE III—AVERAGE TEMPERATURES

	Barberton Plant	Limeton Plant
Temperature of steam at throttle in deg. Fahr	649.8	610.0
Superheat at throttle in deg. Fahr	256.1	215.0
Temperature of steam to low-pressure cylinder in deg. Fahr	443.6	421.0
Superheat to low-pressure cylinder in deg. Fahr	181.7	162.0
Temperature of feed water in deg. Fahr	.....	116.0
Temperature in throttling calorimeter in deg. Fahr	254.0	290.3
Temperature of stack gases in deg. Fahr	500.0	526.0

TABLE IV—MISCELLANEOUS AVERAGES

	Barberton Plant	Limeton Plant
Speed of engine, revolutions per minute	201.00	201.40
Indicated horse-power of engine	257.11	244.08
Average kilowatt output per hour	169.38	150.55
Moisture in steam, per cent	3.62	1.82

is driven from the engine half of the coupling and the exciter from this generator half so that each auxiliary always starts with the unit it serves.

TABLE V—TOTAL QUANTITIES

	Barberton Plant	Limeton Plant
Weight of coal, as fired, pounds	4117.00	4098.0
Moisture in coal, per cent	6.61	5.2
Total dry coal consumed, pounds	3845.00	3885.0
Total ash and refuse as weighed from test, pounds	726.00	726.00
Percentage ash and refuse from test on coal as fired	17.63	18.0
Percentage ash and refuse from test on dry coal	18.88	18.7
Percentage ash by analysis on coal as fired	17.61	.....
Percentage ash by analysis on dry coal	18.85	13.88
Combustible from test, pounds	3119.00	3159.00
Combustible from analysis, pounds	3120.00	3345.0
Total kilowatt-hour output	1355.00	1355.0

TABLE VI—HOURLY QUANTITIES AND RATES

	Barberton Plant	Limeton Plant
Coal as fired per hour, pounds	514.6	455.33
Dry coal per hour, pounds	480.6	431.70
Combustible per hour from test, pounds	389.9	351.00
Combustible per hour from analysis, pounds	390.0	371.7
Dry coal per square foot grate surface per hour, pounds	35.6	32.0
Dry coal per square foot heating surface per hour, pounds	1.0	0.9
Kilowatt output per hour	169.38	150.5

Results of Acceptance Tests Please Owners

Acceptance tests on a single unit in each of these two stations were made for the owners, Mr. O. C. Barber and Mr. H. V. Briggle, by Mr. F. G. Estep, of the Carnegie Technical Schools at Pittsburgh. Samples of the coal fired during each test were sent to the Pittsburg Testing Laboratory, and the results of the laboratory tests follow the acceptance-test data. During the tests indicator cards were taken every fifteen minutes,

TABLE VII—ECONOMIC RESULTS

	Barberton Plant	Limeton Plant
Coal as fired per indicated-horse-power-hour, pounds	2.00	1.865
Coal as fired per kilowatt-hour, pounds	3.03	3.03
Dry coal per indicated-horse-power-hour, pounds	1.87	1.77
Dry coal per kilowatt-hour, pounds	2.84	2.87
Combustible per indicated-horse-power-hour from test, pounds	1.52	.....
Combustible per kilowatt-hour from test, pounds	2.31	.....
Combustible per kilowatt-hour from analysis, pounds	2.31	.....
Heating value of coal as fired in pound-Fahrenheit heat units	10,555.0	11,416.0
Heating value of dry coal in pound-Fahrenheit heat units	11,302.0	12,148.0
Pound-Fahrenheit heat units per kilowatt-hour	32,098.0	34,834.0
Pound-Fahrenheit heat units per indicated-horse-power	21,135.0	21,486.0
Efficiency between engine cylinders and switchboard percentage	88.3	82.5
Over-all thermal efficiency per cent	10.63	.....
Indicated horse-power per kilowatt	1.52	1.62

and the load on the engines was maintained practically constant by shifting the electrodes of a water rheostat as an indicating wattmeter showed fluctuations in the load. The total electrical output was measured by a watt-hour meter.

Both of these plants have been in operation now for several months, and the owners, after having viewed the test data and the daily operation of the machines, have

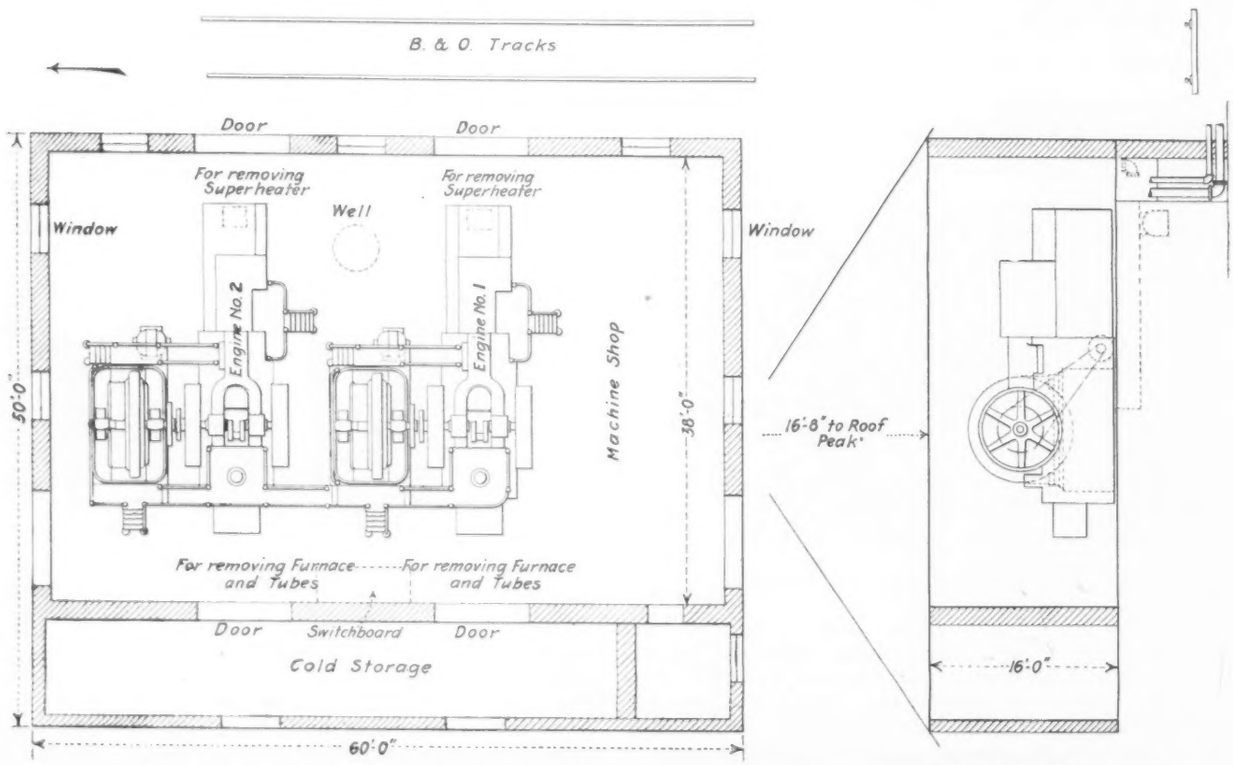


FIG. 8—PLAN AND SECTION OF LIMETON POWER HOUSE, SHOWING POSITION OF APPARATUS

expressed themselves as being well pleased with the performance of the units.

Securing a test average of 3.03 lb. of coal per kw-hr.,

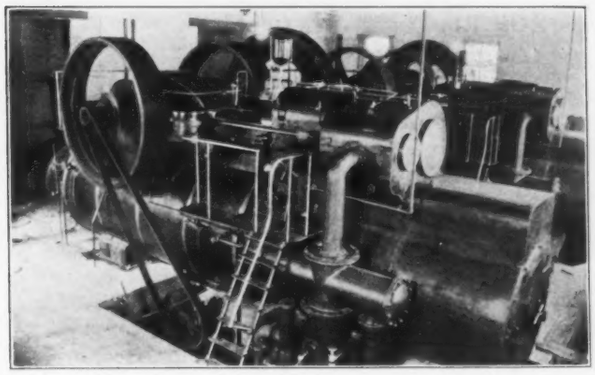


FIG. 9—LIMETON LOCOMOBILE STATION

they point out, is a record to which a fair-sized power plant might well point with pride, and since both tests have shown consistently that this character of performance is possible with these 150-kw units using coal as it comes from the hill, they feel well satisfied with the results of their experiment in this regard.

TABLE VIII—COAL ANALYSIS

	Barberton Plant	Limeton Plant
Moisture, in per cent	6.61	5.20
Volatile matter, per cent	33.59	37.13
Fixed carbon, per cent	42.19	43.79
Ash, per cent	17.61	13.88
Sulphur, per cent	2.77	2.89
Pound-Fahrenheit heat units per pound of dry coal	11,302.00	12,148.00

Circulating-Oil System of Lubrication

On small turbines the sight-feed drop oiler has been superseded by ring-oiled bearings, but turbines rated at

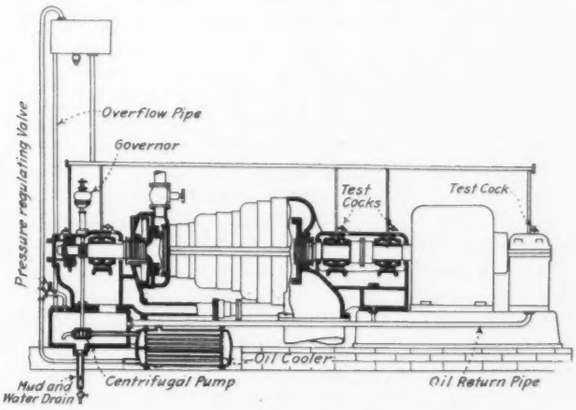


FIG. 1—GRAVITY-FEED LUBRICATING SYSTEM

300 hp and up are usually lubricated by the circulating-oil system. The governor spindle can be employed to drive a centrifugal oil pump which takes oil from the settling tank and delivers it through an oil cooler either directly to the bearings or to an elevated tank from which the oil can be distributed by gravity. If an elevated tank is used, an overflow pipe should connect it with the settling tank. Both tanks should be provided with drain cocks through which water and sludge may be removed. Elevated tanks are nearly always omitted except in very large installations.

With the direct-pressure system the Vacuum Oil Company, Rochester, N. Y., suggests connecting a pressure-regulating valve in the delivery pipe near the oil tank so that an adequate supply of oil at constant pressure will be furnished under all conditions, the surplus being returned to the tank. It is also good practice to have oil-flow indicators in return pipes from each bearing. Test cocks fitted in the middle of the bearing caps furnish another method of determining whether an adequate supply of oil is being furnished.

If oil is used for lubrication only, the pressure required may amount to 3 lb. to 35 lb. per sq. in., depending on the size of the machine, the design of the journals, etc. Frequently, however, the same circulating system is required to furnish oil for operating the governing mechanism. In this case pressures as high as 85 lb. may be required. If the oil pressure drops, the turbine will usually come to a standstill automatically before the bearings can be injured by insufficient lubrication. Elevated tanks should be designed to hold

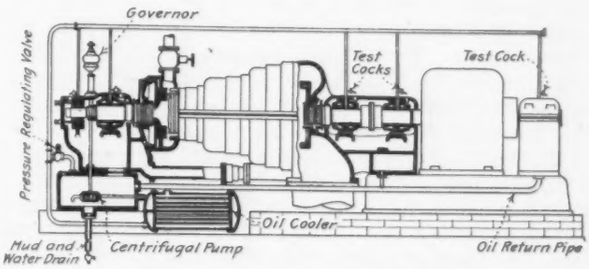


FIG. 2—CENTRIFUGAL-PUMP OIL-CIRCULATING SYSTEM

enough oil to lubricate for at least half an hour so that failure of the tank-filling pumps will not require immediate stopping of the lubricated machinery. When a direct-connected pump is employed to circulate oil through the bearings the supply will not be adequate until the turbine is running at one-quarter speed or higher. Therefore, before starting a turbine oiled in this manner it may be necessary to supply lubricant temporarily with a hand-operated pump or from an auxiliary system.

Utility of a Water Trap

Where leakage of water into an oil system cannot be prevented a water trap attached to the lower oil tank may be of great service. The trap should be drained before starting machines and about twice every twenty-four hours, letting the sludge and water run until clear oil appears. The suction of oil pumps should be from 4 in. to 6 in. above the bottom of their respective oil tanks so that water will not be drawn into the pumps when the contents of the reservoirs are agitated. When small oil-storage tanks are employed or when considerable water becomes mixed with the oil it is advisable to draw off 3 gal. to 6 gal. each day for purification and replace it immediately with an equal quantity of oil which has been treated. Water can be distilled from oil by treating it in a steam-heated separating tank. Other solid impurities can usually be removed with mechanical filters. Wherever possible it is good practice to have large settling tanks and to allow the oil plenty of time to separate from water and other impurities before it is re-circulated.

The Diesel-Type Engine in the United States

Some Reflections Upon the Slow Adoption, the Inadequate Recognition and the Promising Future of the High-Economy Oil Engine in This Country

By R. W. Crowly

TO thoughtful and well-informed engineers who have a knowledge, or at least an appreciation, of the extensive service being rendered throughout the world by the Diesel type of oil engine it is a matter of wonderment that a prime mover commanding such respect, confidence and favor in other countries should have earned so little patronage from American engine users. There are no instantly obvious reasons to account for this relative lack of support, and the seeming indefiniteness of the situation unfortunately breeds and fosters to some extent an underlying suspicion that the engine is not suited to the conditions of the United States.

Many engineers—most, in fact, of that large number to whom the Diesel type of engine is but a name—dare in their ignorance to commit themselves to the expression of unfavorable conclusions as a ready key to the contrast between the American and European adoption of this engine. Not infrequently one actually hears the assertion made in dogmatic fashion that the engine should be regarded as a failure, being unreliable to a high degree. Too seldom are good words said of it.

The American atmosphere surrounding the Diesel type of engine is unhealthful. It has been fouled, chiefly by the ignorant, partly by the enemies of the engine, and to a certain extent and unconsciously by some of those who were most friendly toward it. In these surroundings the engine has not thriven. To purify and cleanse this atmosphere there could be no better agent than light, the light of knowledge. This is difficult to spread. Ingrained objections and prejudices are hard to overcome, and moreover the sort of knowledge that counts—namely, the knowledge arising from familiarity with these engines and with their regular daily work—can grow only with time. Sure it is, however, that much can be told to instil confidence and to banish the ignorance that so largely prevails.

How the Introduction of the Engine in Europe and America Differed

In Germany two of the most honored names in the industry were bound up with the engine from its inception, and to these were added others directly the commercial production started. Such ties were of the very greatest value as guarantees of the engine, for not merely was it evident that firms of this rank would support only an engine of provable satisfaction but it was clear also that the productions would be durable.

The early confidence displayed in the Diesel type of engine in Europe was undeniably due in a very large measure to confidence in the firms that produced it, and these firms, being careful and jealous of their reputation and good name, could not afford to take, and did not desire to take, the slightest risk in their work. In Switzerland, in Belgium and in England, and very little later both in Holland and Denmark, a similar influence prevailed, the Diesel engine becoming linked with leading manufacturers, who cared for it and guided it through the difficult days when the number of those who could attend to it and who could diagnose and cure its ailments were startlingly few.

To the countries named above there remains to be added Russia, which earns special consideration, for it is a country where such "skilled labor" as can be obtained falls far short in quality of that available in other lands. The Russian licensees had always been compelled to work under this handicap, which was no novelty to them when they undertook Diesel-engine construction, but with the assistance of foreign foremen and at the cost of much material they have habitually overcome the disadvantage, and their Diesel sets have performed always very satisfactorily.

In Sweden the unique case was seen of a new factory established purposely and solely for the production of this class of oil engine, and that factory has earned for its various stationary and marine sets a reputation that is unexcelled in Diesel circles, the Swedish engines having been always among the very soundest and most conscientiously built.

Alone in this country and in France were no special arrangements made with prominent engineering firms, the rights being held instead by "office" companies, which ordered engines by contract, now from one factory and then from another. The continuity of work needful to detailed progress and advancement was absent from the constructor's efforts; the interest and tradition were lacking, and no trained experience accumulated in the workshops. The French Diesel Company went into liquidation about 1904 or 1905, when all the other European Diesel concerns were prospering greatly; nor was the American Diesel Engine Company successful.

Writing with personal knowledge of the opinions held by the Diesel engineers in the various European countries, I can state that the slow adoption of this class of oil engine both in France and in the United States is attributed by them to the numerous disadvantages arising from the manner in which the patents were exploited in these two countries. These disadvantages were far-reaching and affected both the sales and the character of production, consequently influencing also the later performances of the engine sets in their industrial service.

In the United States the patents originally granted to Diesel were never challenged. In many of the European countries, however, their validity was disputed, and, although from about 1903 onward some of the manufacturers ceased to pay royalties, no legal steps were taken to enforce whatever rights the patents conferred, and newcomers of high standing entered the business with some freedom before the year in which the patents were supposed to expire. Naturally this competition was more stimulating to business than was the American monopoly, and it is reasonable to suppose that had the holders of the United States patents promoted and encouraged various sound engineering firms to build under license the volume of Diesel-engine trade in this country would have been greater.

Again one may turn to Russia for an interesting comparison. By the terms under which the patent rights were transferred to the Russian firm unrestricted freedom of sale was reserved to the M. A. N. company of Germany, which has profited considerably thereby. The Russian factory that had the privilege of building this class of oil engine found it advisable at a later date not merely to grant a license to a second firm within the country, but it also supplied the orders to start the Diesel-engine business of the newcomer and at times even bought engine sets in Sweden in order to be able

to give rapid delivery in times of pressure. The result has been that these two firms in combination of output have produced a greater horse-power for Russian river boats alone than is installed on United States territory for all purposes, and in the stationary style of engine their aggregate is several times beyond the United States figures. That result was obtained not only with competition between those two firms but with a third very strong competitor also in the field.

In the lack of powerful and responsible engineering associations behind the introduction of the engine and in the protracted absence of competition to stimulate it one finds the two fundamental factors that retarded the adoption of the Diesel-type motor in the United States. The first factor, of course, takes into account the shortcomings charged against the original American engines, and undoubtedly the first of the American-built sets were far from the equals of the European contemporary types. Perhaps also the class of attention and supervision devoted to the motor was not of a character favorable to the best results, but one must not overlook that in the early days of the Diesel engine in Europe no other men were found to tend them than the ordinary "drivers" from steam plants.

The Establishment and Scope of the Engine

A large school of thought in this country professes to find in the steam turbine and in the water turbine two unconquerable opponents to the commercial advance of the Diesel oil engine in the United States. While, however, it is perfectly true that the hydroelectric plants loom large in the power economics of this country, and while also the period of development and the spread of the steam turbine have coincided with those of the Diesel engine, it is absurd to shut from one's view the far more numerous installations and potential installations where neither style of turbine could, or would, be taken into account.

By virtue of the great power of some of the later units the steam turbine has attracted and compelled an amount of interest and attention out of proportion to the part it plays in the industrial economy of the nation. For similar reasons the hydroelectric schemes have captivated the minds of very many people, and, moreover, no small amount of publicity has been earned for them by the interested financial parties. The glamour surrounding the steam turbine and the water turbine has elevated them to heights they would not have reached and would not occupy on material results alone. The 30,000-kw turbo-generator and the 300,000-hp hydroelectric plant do not constitute the entire power machinery of the country.

The small factory, the isolated pumping works, the generating station of the small town, the power house of the remote quarry or mine—these are not turbine possibilities. The *small* turbine is largely an engineering affectation, and should be restricted logically to the low-pressure type for economizing exhaust steam. For sets of less than 1000 hp there is a reactive tendency among thoughtful engineers to consider the oil engine, the gas engine or the steam engine, and below 500 hp the circumstances must be particularly favorable to coal if steam is to have the advantage over oil or gas. In any case the oil engine should not be left out of account merely for the sake of prejudice.

Fuel economy alone does not govern the relative superiority of the oil engine or of its competitors, yet only too often upon that basis alone is the oil engine taken into consideration. The Diesel engine has indeed certain specific advantages that should earn for it a place in every electric generating station. If only for the fact that it is always ready to start as quickly as one can open a few cocks and handle a few levers, it should earn the goodwill of every station engineer. Not often does one meet the emergency when extra power is required suddenly and unexpectedly before extra boilers can be forced, but when the need arises it generally makes itself felt very badly. It was with this in mind that the chief engineer of one of the largest electric supply companies in the United States told me that if he could get an oil engine of 30,000 hp he would buy it at once, for the sake of the assistance it would give him in times of sudden stress.

In Europe it is becoming regular practice for the electric light and power companies to provide themselves with this useful form of reserve. The large companies install Diesel engines in their substations, the plant occupying little more space than a rotary converter or a motor generator, and the substation thereby becomes endowed with a certain small measure of independence, which in case of trouble on the cables can prove useful. Smaller companies install the Diesel engines in the central station, and it has very generally been found that owing to the splendid economy shown by the Diesel-type engine at all loads a great saving is effected by running the oil engine during the night to deal with the small demand that occurs when practically no motors or domestic lamps are in use. Even with the high price of fuel oil in the United Kingdom, the Diesel engine has become an accepted prime mover for the central station. In Germany, where the domestic tar oil is obtainable at a price lower than the cost of duty-free imported fuel oil in England, a similar tendency is shown.

Indeed, in Germany there are several instances where large sets of 1600 brake-hp have been installed in central stations, this power being considerably in excess of any English practice. Italy also furnishes an outstanding example of the modern tendency. Inasmuch as, the hydroelectric plant for the city of Rome having been loaded to the due capacity of the falls, it became necessary to erect an auxiliary generating station within the city, for that purpose three Diesel-engine sets of 1500 hp each were selected. In Russia, of course, there are numerous generating plants where only oil engines are in service, and other European countries exhibit the tendency to a greater or lesser extent.

The relative prices of coal and oil and the relation between the best fuel consumption of the turbine and that of the oil engine are not the alpha and omega of the problem. The relative fuel consumption at low loads, for instance, may be far more important—it depends upon the local conditions. Instant readiness for service may prove of the greatest value and yet not be translatable into figures. Price of real estate may determine whether an oil engine squeezed into a small available space is cheaper than an extension of the boiler house and engine room to take extra steam machinery. If water be valuable, the very small demand which an oil engine makes upon the supply will be an outstanding benefit. If labor be expensive, the saving with the oil engine will be considerable. Again, the absence of fire, smoke and smell in connection with the compactness and smooth-running qualities of the engines and the absence of stand-by losses render this class of engine specially suitable for the power plants of hotels, department stores and other great city buildings.

In Europe scarcely any great edifice is erected in any city that does not have its own Diesel generating equipment. It is said that the steam heating required in winter in the United States cities renders the steam-power plants the more advantageous, but this certainly needs qualification, for the combination of steam plant and Diesel engines is in such cases most frequently the more economical and more convenient. In the northern cities of Europe, where vigorous winters prevail, requiring the regular steam-heating system as practised in

this country, the oil-engine generating plant has been proved to have the balance of merits. In the Tietz department stores, for instance, in the big German cities the Diesel engines are a regular feature, the average installation being of about 500 hp and the largest (in Berlin) being about 1000 hp.

Among other applications of the Diesel-electric plant in Europe only one more will be mentioned, its interest being altogether special. In the electrification of the suburban lines of one of the railroads running out of London a proposal is under consideration to equip several outlying substations with generating machinery turned by Diesel engines, the intention being to employ these sets to boost up the distant sections during periods of heavy traffic, thus permitting considerable economies to be made under the item of feeders alone, while also an element of decentralization is introduced into the system, affording some protection against dislocation of traffic by transmission faults.

Future of the Diesel Engine in the United States

It cannot be doubted that in the United States the Diesel engine must in future years find a more widespread adoption than in any other country. It is strange to contemplate that in this territory, whence is derived about two-thirds of the oil supply of the globe, there should be not more than 5 per cent, and probably less, of the total Diesel engine power operative throughout the world. Some twelve months ago I computed that Diesel engines were developing an aggregate of 1,800,000 hp. This figure is not strictly accurate, but is a close estimate, for it is largely composed of definite totals supplied to me by various manufacturers, and where a guess had to be made I sought estimates from various competing firms and took the mean. During the year 1914 the aggregate has increased probably to little, if any, short of 2,250,000 hp.

Definite influences have retarded the progress of the Diesel engine here. They are now being removed. The industry is becoming so established that the shortcomings of the less competent and less high-minded will be far outweighed by the successful achievements of the serious, conscientious and able firms. The growth of the industry must of itself establish confidence among engineers. One can point around the world to indicate that by no possible process of reasoning can the Diesel engine be regarded as experimental. It is to-day as firmly proved as the steam turbine, and when this concrete fact shall have impressed itself upon American engineers this high-economy oil engine will begin to assume the place it deserves in the American power world, where its opportunities and possibilities are of huge volume.

It does seem that the number of American engineers who seek enlightenment about Diesel engines and are open to conviction is increasing at a noticeably more rapid rate than has previously been known here. Some dozen manufacturers are either now manufacturing or have announced their intention to construct Diesel engines, and this display of manufacturing activity seems to have quickened the interest of power engineers. Unfortunately, it is to be feared that not all of these producers will pursue their task with the seriousness, earnestness and deep respect which the Diesel engine demands of its constructors if success is to crown their efforts.

As a piece of machinery the Diesel oil engine is more fruitful of intense problems than any class of engine that has preceded it. The high gas pressures impose stresses which, even with the lavish use of metal, require bearing surfaces to be operated more heavily than in previous engine practice, whence the need for more rigid, truer and smoother bearings and journals, with the minimum of slack, and the need for regular, even-spreading and unfailing lubrication. Everywhere the pressures are so much higher that the fit of every working part must be true and conscientious if hammer and wear is to be avoided. Depending for its very operation upon the maintenance of the gas pressures, the engine must have absolute tightness at every part subjected to gas pressure. There must be no warping, straining or play. Rigidity and true workmanship impose their need at every point and at every part. Over and above all, more important than the rest, more difficult to deal with are the problems arising from the intense heat conditions.

These in themselves are a study of years. It is they which bring inexperienced firms to grief still at the present day. To overcome them has cost many a firm a small fortune, and in the largest engines they have not yet been overcome. They are so intense that they jeopardize the existence of the two-stroke-cycle types of Diesel engine, where their influence is so much greater than it is in the "four-cycle" types. Their subjection is the greatest secret of Diesel-engine construction, and it is in order to take the short and sure cut to success that some firms pay license money to experienced European builders. The profound and intimate experience of years of Diesel-engine construction counts greatly also in the mechanical design, for it is only by eliminating the failures in petty details during the course of years that the leading builders have succeeded in making their Diesel engines as trustworthy and dependable as any form of prime mover of these latest days.

Oil Temperatures Indicate Conditions of Bearings and Coolers

It is just as important to maintain safe bearing temperatures as it is to furnish an uninterrupted supply of steam to an engine, therefore it is advisable to take temperature readings frequently and periodically. On high-speed machines it has been suggested that readings be taken every half hour and never farther apart than every hour. To minimize the work of reading temperatures, and to furnish information which may be required in tracing causes of overheating, temperatures might be taken at the following places: At each main bearing or in the oil return from each bearing, at the oil entrance to the oil coolers, at the oil outlets from the cooler, at the cooling-water entrance to the cooler, and at the cooling-water outlet.

Under normal conditions the temperatures of oil leaving each bearing should not exceed 130 deg. Fahr. If it does and the temperature of the cooling-oil outlet is fairly low, there may be steam escaping at the bearing, the oil may have broken down or may not be circulating fast enough. If the temperature of the oil delivered to the bearings has risen considerably, it may have been caused by too slow a flow of water to the cooler, by the oil depositing impurities on the cooler tubes, or by the water causing the formation of scale which hinders the transfer of heat.

Too slow water circulation will be indicated by an unusually large difference of temperature between the water inlet and the water outlet. Poor heat transfer is indicated by the oil outlet temperature being high, the difference between water inlet and outlet temperatures being smaller than usual. By making a record of temperatures under different conditions when the machine is operating properly and the cooler is known to be clean, and referring to it when readings seem to be at variance, the cause can generally be determined with accuracy.

INSTALLATION OF STEAM PIPING

Points to Be Observed in Arranging the Mains and Fittings

BY S. U. TUSPIN.

A steam pipe has just one purpose, namely, to convey steam from one place to another; however, it should accomplish this purpose with efficiency and safety. The element of safety depends on the quality of the piping and its fittings, the arrangement of the various parts, and the nature of the workmanship displayed in the erection of the piping.

So far as safety due to the quality of the materials is concerned, there need be little apprehension, provided that the piping and the fittings are purchased from firms of recognized standing and good reputation. Their products have been thoroughly standardized and tested, so that they may be relied on to withstand all the stresses for which they were designed.

When the matter of arrangement is considered, however, there are many things that may arise to render the installation unsafe and make it a constant danger to the attendants. The most common of these is improper provision for the drainage of pipes. Great care should be taken to put up the piping, if possible, so that there will be no low spots, or pockets, in which water can collect. If this be neglected, there will always be danger of disaster through water hammer.

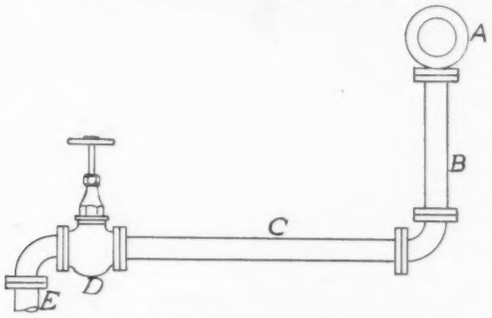


FIG. 1—FAULTY CONSTRUCTION, WITH DANGER OF WATER HAMMER

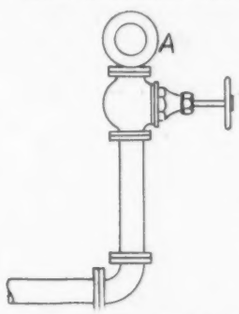


FIG. 2—CONSTRUCTION WHEN HEAD ROOM IS LIMITED

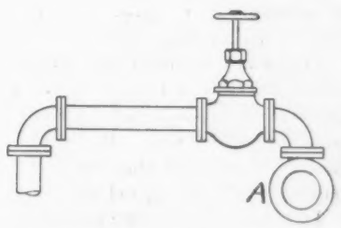


FIG. 3 — CONSTRUCTION WHEN HEAD ROOM IS AVAILABLE

The rate of travel of steam in pipes is in the neighborhood of a mile a minute. Now, if a body of water is allowed to collect in some part of the piping system and steam is then admitted, the water will be picked up and carried along by the steam current. Water is practically incompressible, and if a slug of it is swept along a pipe at a velocity of a mile a minute and strikes an elbow or a valve, the effect is the same as though the fitting had been struck by a metal hammer weighing as much as the water and moving at an equal speed. The result of this action may be a cracked valve or fitting, a split pipe, or an injured employee.

An example of faulty connection inviting water hammer is shown in Fig. 1. From the main steam pipe *A* is led the supply pipe *B*, which joins a horizontal run *C* on which the valve *D* is located. The pipe *E* on the farther side of the valve leads down to an engine. Now, when the valve *D* is closed, the piping between the main and the valve is filled with live steam and all condensation that occurs collects in the horizontal pipe *C*. If the valve *D* is suddenly opened, the rush of steam will carry the water along and will throw it violently against the valve, putting a heavy stress on it as well as on the pipe *C*.

An installation containing an arrangement like that shown actually failed by rupture of the pipe *C* at the side, near the valve *D*, and the attendant who was opening the valve was directly in the line of the escaping steam and was scalded to death. Such a result would have been impossible if the pipe *C* had been properly drained by a drip pipe connected just in front of the valve *D* and led away to a steam trap; also, it would not have happened if either of the methods of arrangement shown in Figs. 2 and 3 had been used.

It is not always possible to avoid the formation of pockets in piping, owing to the lack of head room, interference with walls or other parts of the building, and similar reasons. In every such case the pocket should have a drain pipe leading to a steam trap, so that the condensation may be removed as fast as it forms. Even then, the traps should be inspected to see that they are in working order. A trap that is inoperative is worse than none at all, because it lulls the attendants into assuming that all is safe and secure, when in reality no safety or security exists.

Another point to be observed in connection with the condensation that occurs is to slant the pipe so that the water of condensation flows in the same direction as the steam. If the pipe is inclined in the opposite direction, the water will run back, counter to the steam current. The rapid flow of steam may retard the flow of the condensation to such an extent that a slug of water will be formed at some point. This, picked up and driven by the steam, will produce water hammer and its attendant dangers.

The construction of the straightway globe valve is such that in certain positions its seat may form a pocket in which water will collect. For this reason it is well to avoid the use of this form of valve, and to install proper drips whenever any other valve must be placed in such a position that, when closed, it traps water in the pipe.

To insure safety, provision must be made for the movement of steam pipes under the effect of expansion and contraction due to changes in temperature. In the case of pipes leading from the boiler nozzles to the main line, the change of length may be taken up by the natural spring or elasticity of long-radius bends; or a long riser from the boiler and a long horizontal pipe to the main, with an angle valve at their junction, will serve the same purpose.

In the case of a long, straight steam main, however, the movement is all in the direction of the axis of the pipe and cannot be taken up by bends. The pipe may then be anchored rigidly at a point near the middle, and the ends be left free to come and go, roller brackets or long suspension rods being used to permit this movement.

Another way is to anchor the ends of the main firmly and to insert a slip joint or an expansion joint near the middle. Any arrangement, whether by accident or design, that holds the pipe rigidly throughout its length is dangerous. The forces set up by heating or cooling a line of pipe are very great, and proper allowance must be made for them.

When erecting piping it frequently happens that the

flanges do not come truly in line with each other, so that when the flange bolts are tightened a bending stress is set up in the pipe. If bends of long radius are used, this stress will be taken up by the bending of the pipe; otherwise the flanges should be faced so that they will meet evenly, without causing any bending stresses in the piping.

In order that the steam shall be conveyed with efficiency, the losses on account of the drop in pressure due to frictional resistance and condensation due to radiation must be made as small as possible. The resistance to the flow of steam through a pipe is caused by the roughness of the inside of the pipe and its fittings, the contracted openings through valves, and the changes of direction of flow due to elbows, tees, valves and other fittings. To reduce the friction to a minimum, therefore, there should be as few fittings and changes of direction as possible.

Of course, the simplest and most efficient way would be to use a straight pipe leading from one point to another; but the layout of the plant, the connection of several units and matters of a similar nature may necessitate the use of many curves and fittings. As a consequence, it is advisable to use bends of long radius in preference to short elbows, as they will retard the flow less and thus cause less drop in pressure.

There is an additional advantage in using direct lines and long-radius bends, there being a reduction in the amount of piping and consequently in the first cost for material and labor. Moreover, the number of joints is decreased, so that the expense of keeping the piping free from leaks and in good condition will be lessened.

The diameter of the pipe has a definite relation to the friction, and hence to the drop in pressure. The smaller the diameter, the smaller the cross-sectional area of the pipe, and the more rapidly must the steam travel in order that a given amount of steam may be transmitted in a given time. The more rapid travel results in an increased loss of pressure between the entering and discharge ends of the pipe.

On the other hand, the use of large sizes of pipe has its disadvantages; for, while the velocity of flow and the drop in pressure may thereby be reduced, there will be an increase in the weight and cost of the pipe and its fittings and in the loss of heat due to greater radiating surface. It therefore becomes necessary to compromise between excessive loss of pressure and excessive cost and radiation loss. The result has been that live-steam pipes are usually made of such size that the steam will have a maximum velocity of 6000 ft. per minute.

The valve equipment for a system of steam piping is expensive and forms a large item in the total cost. For this reason unnecessary valves should not be used. To this objection must be added the increased cost of upkeep. The packings of valve stems harden and crack, and leaks develop. The larger the number of valves, the greater will be the chance for leakage and the greater will be the cost of keeping valves in good condition. Moreover, needless valves add to the resistance to the flow of steam.

More thought should be given to the location of valves on steam lines. As far as possible, they should be placed in easily accessible positions. Too often it is necessary to maintain a precarious balance at the top of a ladder or to lean out from a platform or gallery to reach the hand-wheel. The safety of the workman should be considered. In closing or opening a valve he should not be required to stand in such a position as to be in danger of being scalded if a pipe or valve should burst. Above all, he should not be compelled to go down into a closed pit to adjust a valve carrying steam. The valve stem should be carried up to the floor, where it can be reached without risk or trouble.

Gland Packing

As steam leaking out of the high-pressure stages of a turbine or air leaking into the exhaust passages would greatly decrease the efficiency of the machine, it is important that the glands be properly packed. To seal the glands, many engineers employ carbon rings, labyrinth packing or water seals. Carbon rings, which are usually arranged as shown in the accompanying drawing, are made of several segments which can be held in place by long, helical springs. Steam can be

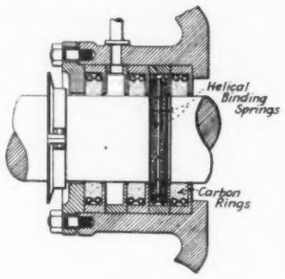


FIG. 1—CARBON-RING PACKING

admitted to the pipe opening into the chamber surrounding these rings to increase the pressure between the segments and the journals. Where the pressure on the rotating shaft is liable to be large it is sometimes customary to feed oil into the gland to prevent wear of the shaft and also to improve the sealing effect of the packing.

Labyrinth packing is usually employed at both the high-pressure and low-pressure ends of a turbine. Where this packing is to be employed the shaft has to be provided with a number of collars as shown in the accompanying sketch. Packing rings are then fitted into grooves in the surrounding casings so as to lie between the collars on the shaft and offer only a zigzag path for steam which may tend to escape that way. Whatever steam may leak past the rings should be allowed to escape through a pipe attached to the casing.

Low-pressure labyrinth packings are similar to the one just described except that the pipes connected to the casings should be used to introduce steam at low pressure into the packing so that when the latter leaks

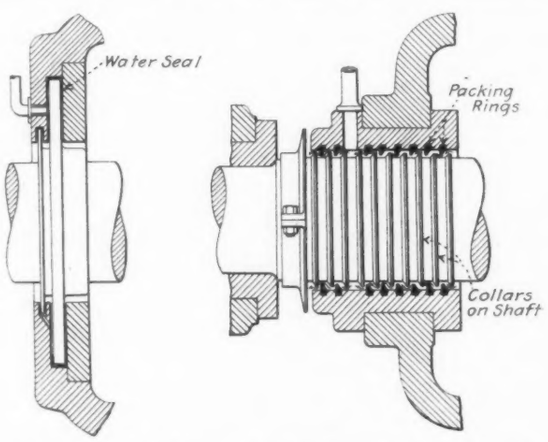


FIG. 2—WATER SEAL AND LABYRINTH PACKINGS

steam will be admitted and not air. Water seals usually consist of a collar on the shaft which is revolved inside a casing into which a constant supply of water is admitted under pressure. The water which is thrown by centrifugal force to the periphery of the circular chamber forms a barrier to leakage along the shaft.

Machine-Tool Performance Diagnosis

Lessons of the Power-Time Characteristic and Value of Automatic Records on Analyzing Productive Operations

WHAT the indicator is to the steam engine the graphic wattmeter may soon become to the motor-driven machine tool. Records of this valuable instrument afford a simple and accurate basis for judging machine performance and diagnosing the causes of delays and of inefficient use of control equipment, checking the fitness of a given motor equipment for the existing service, and illustrating the effectiveness of various brands of tool steel, special shapes for cutting, grinding, etc. Tests show that the actual accuracy of a graphic wattmeter may be about 90 per cent, although the relative accuracy of different parts of the same record may run still higher.

An example of the usefulness of this equipment is afforded by the following record of operations by a 42-

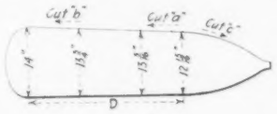


FIG. 1—CASTING (NOT TO SCALE)

in. engine lathe 24 ft. long, the work comprising the rough turning of a 12-in. projectile, the finished weight of which is 1046 lb. The lathe was manufactured by the Pond Machine Tool Company, and was driven by a Diehl interpole, shunt-wound 20-hp, 230-volt motor having a speed range of from 400 to 1200 r.p.m.

The shape of the casting is shown in the accompanying sketch, and the various operations associated with rough turning are indicated by the letters on the diagrams, reproduced from the instrumental record.

Description of Graphic Record

A—Start of first roughing cut *a*. Round-nose tool of high-speed, bearing trade name "Rex AA." Speed is 5.2 r.p.m. Feed is about 0.14 in. Diameter of cut is 12.5 in.

D—Ends of first cut of 23-in. length. Owing to the taper of the casting, the tool is next drawn back to

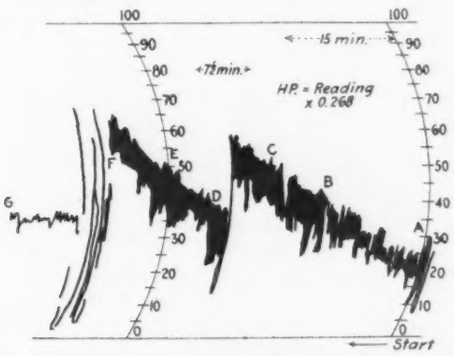


FIG. 2—SECTION OF POWER CHART

give a diameter of 13 1/16 in. for cut *b*. Speed is 2.9 r.p.m., and feed is as at *A*.

F—End of cut *b*, length of which is 14.5 in. A second cut is now taken over *b* to reduce to 12.5 in. Tool breaks at beginning of run and is replaced. Speed is 5.5 r.p.m., with feed as above. This is a cut of constant depth because *b* has already been turned to an even diameter.

H—Tool breaks owing to water crack. A new tool (1½ *P R B C*) is inserted and set for a greater diameter.

M—End of second cut on *b*.

N—The step left by withdrawing the tool at *H* is reduced to a diameter of 12.5 in. The length of this cut is about 6 in.

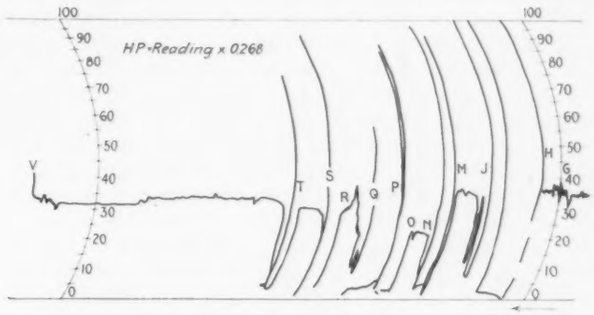


FIG. 3—CONTINUATION OF POWER CHART

O—End of this cut.

P—Circuit-breaker opens twice owing to too rapid starting of motor during adjustments.

Q—Start of second roughing cut on bourrelet of projectile.

R—Shut-down for lunch.

S—Continuing cut on bourrelet, with tool 1½ *P R B C*. Speed, 5.3 r.p.m. Diameter of cut, 12⅛ in. Feed, about 0.14 in.

T—Cut on bourrelet is completed and tool is fed in to cut on body at a diameter of 12 1/16 in., with same speed and feed.

V—End of second roughing cut.

W-X—Adjustments.

Y—A small cut is made at *C* with the same tool.

Z—Stop for different style tool, *P R S B*, for cut on ogive.

1—First roughing cut on ogive. Speed, 13 r.p.m. Feed, about 0.04 in. Maximum diameter, 12⅛ in.

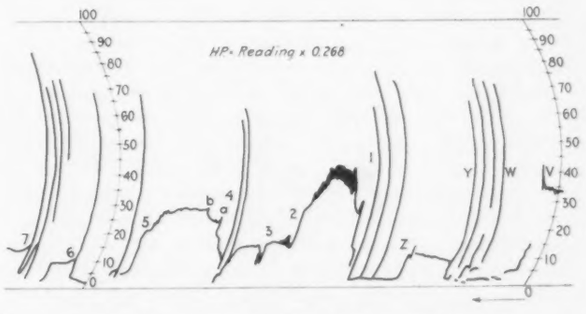


FIG. 4—CONTINUATION OF POWER CHART

2—Owing to heavy nose of casting, the tool is withdrawn to reduce the cut.

3—End of first roughing cut on ogive and start of cut to remove step left by previous operation.

4—Second roughing cut on ogive. As the diameter increases the motor speed is increased at 4 *a*, *b*.

5—End of second cut on ogive.

6—Adjustments for cut on *D*. (See sketch.)

7—Cut *D* is from base to bourrelet. Tool, 1¼ *P H L H*. Diameter of cut, 11 9/16 in. Feed, about 0.04 in.

8—Stop to caliper work.

9—Speed increased to 21.5 r.p.m.

10—End of cut.

11—Cutting off tool ⅜ *P C F E* in post. Speed is 5 r.p.m. at surface, which was increased to about 10 r.p.m. near center of piece.

12—End of operation and work removed from lathe.

Analysis of Diagrams

The ideal power record from *A* to *F* would be a straight line, representing the maximum rate of removal of metal at all parts of the cut. The slope is caused by the increasing depth of the cut due to the taper of the casting. More metal could be removed at *A* by increasing the feed or the speed, the latter being a practicable method. On the assumption that the power required is in a direct proportion to the cubic inches of metal removed per minute, the time of the operation would be reduced by about ten minutes. The cutting speed at *A* is about 17 ft. per minute. To remove the same metal as at *C* it would have to be 45 ft. per minute, a speed which might be prohibited by the scale and sand on the casting. The tool speed for the cut *T-V* is about 17 ft. per minute. If this is the limiting speed, the work could be done in a shorter time by increasing the feed. The question then becomes

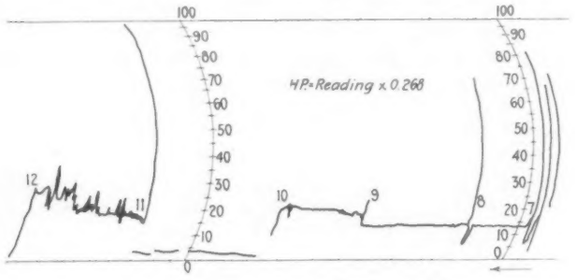


FIG. 5—END OF POWER CHART

whether the tool could stand continuously the cut it carries at C, which is a heavier cut made at the same speed.

In turning down the ogive a radial arm draws the tool slide rest to the spindle, reducing the diameter at which the tool works, as the carriage is fed toward the dead center. The curve of the ogive is thus automatically obtained. The cut 1-2 is of increasing size owing to the heavy nose of the casting. Hence the decreasing power is due to a lower cutting speed at reduced diameters, with the result shown on the curve. The operation 7-10 invites inspection on account of its length. The cut is from base to bourrelet. As the projectile is cast with base upward, the nose is probably the hardest part of the casting. It is therefore difficult to understand why the operator increased the speed at 9, which is at a point more than half way down the stock; or, if the increased speed, 65 ft. per minute, is safe at this point, why it was not used for the whole cut, thereby decreasing the time required. The increase in power from 11 to 12 is attributable to two causes. The spindle speed was increased so as to have the cutting speed more nearly constant as the tool approached the center of the stock, while the tool friction increased as the tool entered the cut, thereby bringing a greater surface of tool against the side of the cut. Allowing for the intermittent load and figuring 75 per cent motor efficiency, it appears that the work might be handled by a motor of 8-hp to 10-hp rating, instead of the 20-hp equipment installed.

Motor Sizes for Flour-Mill Machinery

Estimates of the various sizes of motors required to drive the machines in a modern flour-mill installation were set forth by Mr. T. E. Simpers, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., in a talk before the Ohio Electric Light Association's committee on new-business co-operation at Cleveland, Jan. 20. Among the machines which make up the average flour-mill installation, as enumerated by Mr. Simpers, are grain shovels, car hauls, cleaners, hullers, scourers, roller mills, dust-collector apparatus, sifters, packing and weighing machines, conveyors and elevators.

In the modern flour mill the several milling processes are interdependent, and it is therefore necessary that all of the different sections of the machinery should run as a unit. This is accomplished in many mills by grouping all starting apparatus under the control of a single operator who starts the motors as nearly simultaneously as possible by pushing buttons. Pilot lamps on the switchboard report the operation of the individual motors. Near each machine are placed safety-stop buttons connected to the oil-switch tripping circuits so that if necessary any machine can be quickly stopped without the delay of going to the central board.

Motor-Driven Car Unloader

The power shovel used for unloading grain cars is a device for pulling a large scoop handling grain or similar material across the floor of the car to the door of the latter. The shovel must be guided by at least one man. A 2-hp or 3-hp motor, back-geared and belted from the countershaft to the shovel, makes a satisfactory application. The usual speed for cleaners is 400 r.p.m., and the power requirements are from 0.5 hp to 1 hp for each 100 bushels per hour.

Separators operate at speeds from 500 r.p.m. to 600 r.p.m. The larger sizes having outputs of 1500 to 2000 bushels per hour require 1 hp for each 150 to 200 bushels per hour. In considering the smaller sizes of these machines, a safe rule is to consider 2.5 hp as the friction load of the machine, adding to this 1 hp for each 100 bushels per hour.

Scourers operate between 450 and 700 r.p.m. In the larger sizes, having a rating of 500 bushels per hour, the machines require about 10 hp for each 100 bushels per hour rating. However, considering the smaller sizes, one may safely figure on 5 hp as the friction load, adding 5 hp for each 25 bushels per hour rating.

Wheat-hauling machines operate at 400 to 650 r.p.m., and require about 7.5 hp for each 100 bushels per hour of rating.

Double roller mills as used in wheat milling operate at speeds of from 450 r.p.m. for the 9-in. rolls to 600 r.p.m. for the 6-in. rolls, either size mill requiring about 1 hp per 100 bushels per hour rating.

Sifters, dust-collectors, purifiers and bolters run at slow speeds, approximately 200 r.p.m., and require from 2 hp to 4 hp per machine.

As packing and weighing machines differ in construction, it is difficult to give any idea of their power requirements. Their load is, however, practically a friction load. As a general rule, 5 hp will take care of practically all such machines, including those of larger rating.

Energy Requirements of Flour Mills

The power required by conveyors and elevators can be computed simply from the weight of material elevated, the rate at which it is elevated, and the height through which lifted. For horizontal conveyors it is usual to figure 5 hp for each 100 ft. of 8-in. screw conveyor and 5 hp for each 100 ft. of 24-in. belt conveyors.

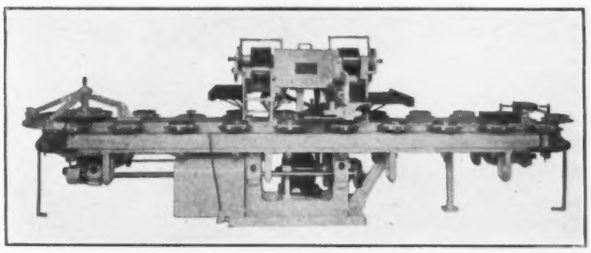
GRIPPER & SUN GUIDE

In verifying the foregoing estimates as added together for the entire mill, including power shovels and car hauls, the general practice is that about 1 hp is required for each 35 barrels of soft-wheat capacity per twenty-four hours and 1 hp to each 3 barrels of hard-wheat capacity per twenty-four hours.

The energy required for flouring mills varies from 2 kw-hr. to 6 kw-hr. per barrel of flour output, depending on the size of the mill and on the per cent of possible production at which it is working, said the speaker in closing. For example, a certain 40-barrel mill showed a specific consumption of 5.45 kw-hr. per barrel of flour, while a 400-barrel mill consumed 3 kw-hr. per unit of output. In the case of the 40-barrel mill referred to, the total load was 14 kw, of which 7.8 kw was due to friction only.

Six Girls, 2 Hp—1800 Pies an Hour

The John R. Thompson Company, a Chicago restaurant firm which extensively advertises the quality of its pies, has installed an electrically operated machine which makes 23,000 pies a day. The pie machine, which weighs 8000 lb. and measures 20 ft. by 4 ft., is driven by a 2-hp motor and operated by six girls. Dough is carried to the machine by men who have prepared it and cut into pieces of the right size to form a bottom or a top crust. Different doughs are used for bottom crusts and for top crusts, the latter being somewhat



MOTOR-OPERATED PIE MACHINE WITH A DAILY OUTPUT OF 23,000 PIES

richer than the former so that it will brown more readily. Standing at the farther side of the machine, as it is shown herewith, one girl feeds bottom-crust dough into a roller, which delivers it, a flattened piece of proper shape and uniform thickness, to another girl who puts it into a pan. This girl drops the pan sharply into one of the pan holders, thus settling the bottom crust into the recesses of the pan without touching with her hands the part of the dough used in the pie. In the pan rack the pie pan then travels around the end of the table at the right, the pan rack being driven by a chain conveyor. As the dough which is to form a bottom crust passes the turn at the right end of the rack dampened brushes moisten the dough at the edge of the pan, so that the top-crust dough will stick when applied. The filling is placed in the pie by a girl just as the pan emerges from the edge dampener. Then the filled bottom crust passes under the roller on the near side of the machine and receives its top crust, which is fed into a roller, stamped with a letter cutter and placed on the pie by two girls. At the left end of the machine the pan holders are lowered and then thrust upward under the beveled wheel shown above the traveling conveyor. The beveled wheel is free to revolve, and as the edges of the pies come into contact with the beveled edge the wheel and the pie pan roll in contact and the extra crust trimmed from the pie is dropped to the flat plane which is a part of the pan rack. As the pie pans leave the beveled wheel they are lifted slightly so that the operator, taking them from the machine, may reach the bottom of the pie pan conveniently.

The motor and all of the gears and the rolls revolve continuously after the motor circuit is closed, but the conveyor may be stopped by moving a hand lever which disengages a friction clutch. The Colborne Manufacturing Company, 157 West Division Street, Chicago, maker of this machine, claims that it can produce 1800 pies an hour when operated at its highest speed.

Card System for Motors

The United Electric Light & Power Company, New York, is keeping track of its motor installations of combined ratings of 5 hp or over by means of cards similar to those shown in Fig. 1 and Fig. 2, which represent the

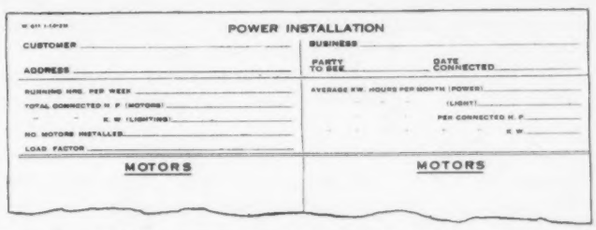


FIG. 1—FRONT SIDE OF CENTRAL-STATION COMPANY'S MOTOR-RECORD CARD

front and back respectively of each card. This system is used only with consumers having a motor load of 5 hp or more, because with the smaller installations it is next to impossible to keep accurate records.

At the top of the card on the front is written the name of the customer, his address and the nature of his business, the number of motors, the total rating and other information as shown in Fig. 1. In the large space under "Motors" is written detailed information about each motor, such as rating, type, manufacturer, speed, type of machine which it operates, whether di-

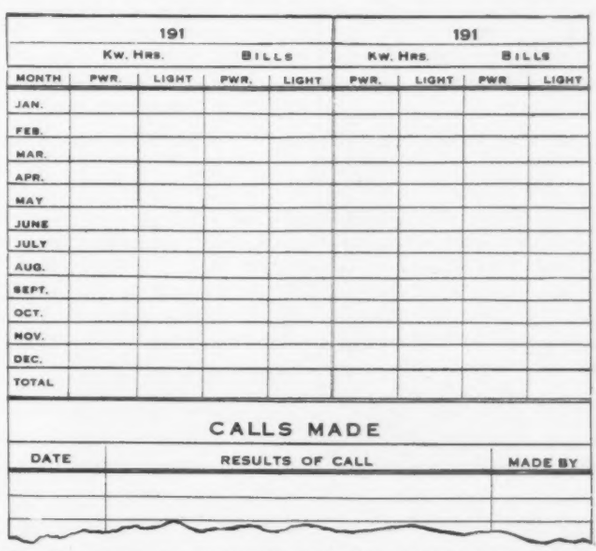


FIG. 2—BACK OF CENTRAL-STATION COMPANY'S MOTOR-RECORD CARD

rectly connected or belt-connected, individual or group drive, etc.

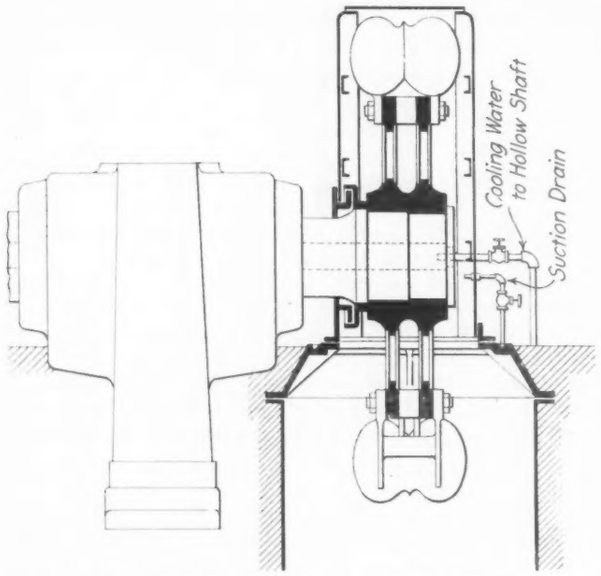
On the upper part of the reverse side of the card which is illustrated in Fig. 2 are kept records of monthly input and the cost thereof, which are entered by the bookkeeping department of the company. Below, under the heading "Calls Made," are tabulated results of periodic calls on the consumer.

Operating Kinks

Disposal of Condensation on Waterwheel Housings

Where waterwheel units exposing large surface areas of casing to the air are operated in hydroelectric power houses, the water of condensation is a source of trouble to the operating engineer. This is usually collected in a channel cast about the periphery of the sub-base and drained to the tailrace. On the 20,000-hp Pelton-Doble units installed at the Drum power house of the Pacific Gas & Electric Company several hundred square feet of surface are exposed to the heated air of the power house, and the resulting condensation is copious. Operating conditions made it inadvisable to utilize the customary drainage tubes, and during the early months of operation much of the operator's time was taken up in mopping the floor and otherwise disposing of condensation collecting in the drainage channel.

The rapidly revolving wheel rotating in the closed casing, by the action of centrifugal force throwing



REMOVING CONDENSATION FROM WATERWHEEL HOUSING

the air outward, produces a strong vacuum about the shaft, and it was decided to utilize this vacuum to draw the water from the drainage channel into the tailrace. A hole was drilled in the casing near the shaft, and a 3/8-in. pipe, fitted with a valve, extended to the drainage channel. At occasional intervals the operator opens this valve, and the condensation collected in the drainage channel is quickly removed.

Same Starting Equipment for Large and Small Machines

Switching equipments in the substations of the Edison Electric Illuminating Company of Brooklyn are arranged so that one set of resistance grids or one compensator can be used to start all of the rotary converters or frequency changers as the case may be without causing short-circuits. The accompanying diagram indicates how the apparatus is connected on the converter and starting panels. To start a machine the field switch is placed in the position connecting the field coils directly across an energized bus and energy is supplied to the armature by closing the positive bus switch, the starting-bus switch, and gradually the five-contact starting switch. Then the negative bus switch and field switch are closed, connecting the windings across the machine terminals, after which the starting and five-contact switch are opened. If the grid resistance connected to the starting bus through a five-blade double-throw switch cannot be used, it can be instantly replaced by a reserve grid by throwing the five-blade switch into the

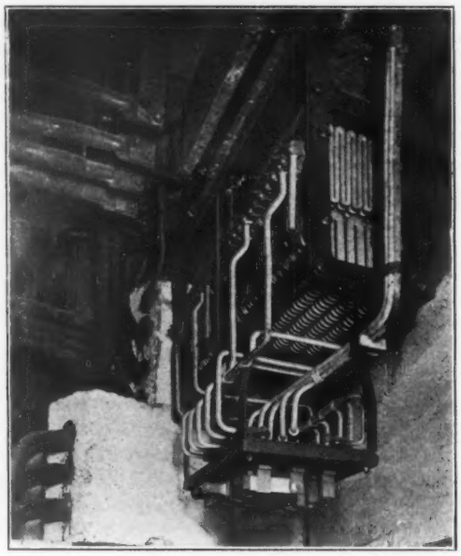


FIG. 1—STARTING RESISTANCE GRIDS AND EMERGENCY THROW-OVER SWITCH

opposite position. After bringing the machine up to synchronous speed by increasing the field resistance the alternating-current voltages of the machine and its respective transformers can be equalized with induction-type regulators, synchronous or split-pole boosters, depending on the equipment installed. Then the converter is ready to be synchronized with the alternating-current system.

To prevent connecting the armature of a converter directly across a bus without starting resistance in series, as might occur if the starting-bus switch on another

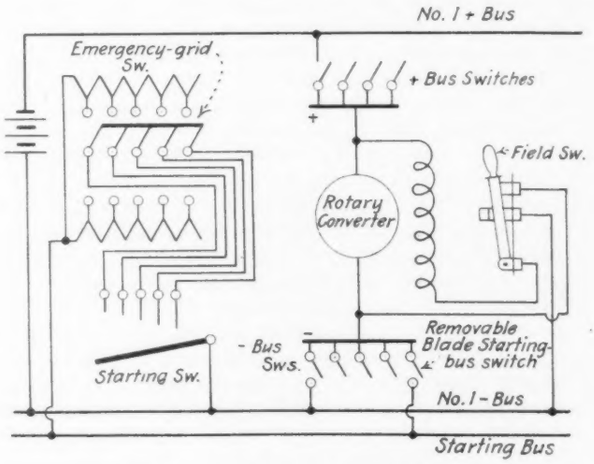


FIG. 2—DIAGRAM OF CONNECTIONS

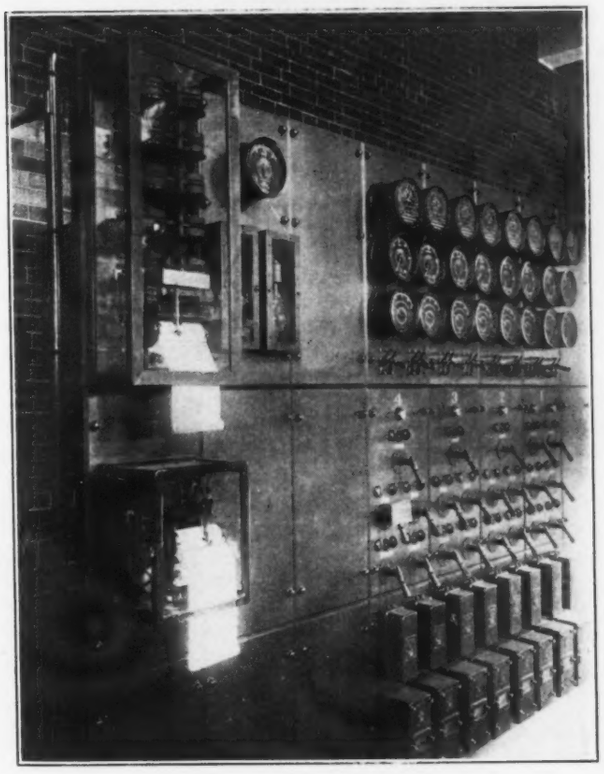
machine panel is closed, the blades of each starting-bus switch have been removed and one quickly insertable blade used for all. The pins are left in each hinge, however, so that the special blade may be slipped into place without any delay.

A similar scheme is employed for starting frequency changers from the same compensator, a reserve unit

being employed in emergencies. In the Hicks Street substation an oil-cooled compensator is used which will start one 2500-kva and three 1250-kva frequency changers in succession without overheating. The larger machine which is being installed and one of the 1250-kva units are equipped with directly connected exciters and enough squirrel-cage bars to increase the speed sufficiently so that the gradually increasing field current will not cause the machines to draw large starting currents. It is reported that these machines accelerate much faster than similar units which are not provided with the permanently connected exciters.

Indicating Thermometers Part of Switchboard Equipment

At the 187th Street substation of the United Electric Light & Power Company, New York City, indicating thermometers connected with all transformer and feeder-regulator windings are employed as a portion of the regular switchboard equipment. Part of the switchboard is shown herewith. After determining the highest temperatures which various pieces of apparatus can withstand without injuring the insulation they will be operated up to this temperature regardless of their rating. So far a temperature limit of 80 deg. C. has been set for the regulators by their manufacturer. Although these regulators are of the air-cooled type, it has been found possible by means of the indicating thermometers to operate them without forced cooling under the present load, thereby saving the amount of energy normally supplied to the blower motors. A temperature limit of 80 deg. C. has also been stipulated for the transformers, which are air-cooled; thus these too may be operated part of the time without forced draft.



SWITCHBOARD EQUIPPED WITH INDICATING THERMOMETERS

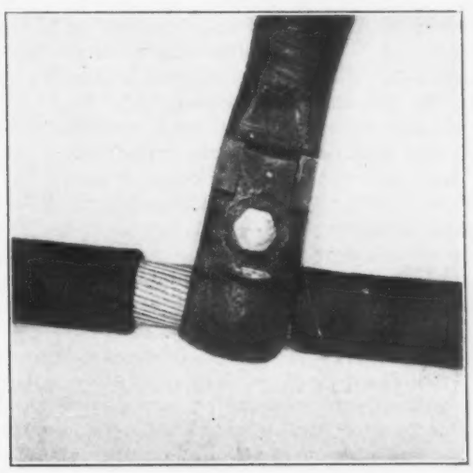
As electrical equipment is rated on the current it will carry without producing more than a certain rise in temperature above 20 deg. C., it can be used to carry heavier loads than its rating where the surrounding temperature is lower than 20 deg. Central-station companies in the colder climates can therefore operate their equipment at higher loads than it is rated for if they employ continuously indicating thermometers for determining when the temperature limit has been reached.

On the panels shown in the accompanying illustration is other interesting equipment, including transfer-bus switches on each feeder panel, instrument-testing switches on the upper feeder panels, differential and reverse-energy relays on the bottom feeder panels, totalizing graphic wattmeter and recording bus voltmeter on the left-hand panel, and emergency lighting relay and regulator-control cut-out on the second panel.

The transfer-bus switches can be employed to connect any idle transformer bank onto any incoming feeder. The testing switches, which are of the double-throw, broken-back type, are designed so that portable test sets may be connected thereto and the instruments named above calibrated without breaking the circuit between the series transformers and the protective relays. The differential relays are connected with the primary and secondary terminals of the transformers so that any fault in the windings will operate the corresponding relay. The reverse-energy relays, assisted by overload relays on the outgoing feeder circuits, confine disturbances to the feeders in which they occur. The totalizing wattmeter is provided with a controller which allows full-scale deflection with maximum load on one or several incoming feeders. To read the chart curve the scale value is multiplied by the number of feeders supplying energy during the interval being considered, and the result is divided by five.

Clamp for Jumper Cable

The accompanying illustration was contributed by Mr. Lewis A. Lewis to the wrinkle department of the Northwest Electric Light & Power Association and shows a clamp used on a jumper cable. One end of the cable is attached permanently to a jumper cable and the other end, as shown, can be clamped to any cable. By this means any two feeders can be tied together or any feeders can be connected to a jumper panel and the switch and circuit breaker cut out for repairs. This scheme eliminates what would ordinarily be two interruptions to the service. For convenience in connecting the Washington Water Power Company, Spokane, Wash., has permanent lugs on the back of the feeder panels but the scheme can also be used on any cable as shown.



CLAMP FOR JUMPER CABLE

Extracts and Abstracts

Safety Second—Service First

Mr. W. H. Blood, Jr., past-president of the National Electric Light Association, in an article with the above head in the January issue of Stone & Webster's *Public Service Journal*, says: "Just at the moment 'safety first' is the popular ailment, so much so that many companies have even exposed themselves voluntarily to this busy bacillus which is bustling all over the land. 'Safety first' may be good as a slogan to wake up the dormant public and to get people to realize that it pays to be careful, but to apply it literally in the operation of a public service property is idle."

"'Safety first,'" Mr. Blood says, "applied to a public service company does not exist, never did, and never should. 'Service first' should be the aim of a public service company. Safety may be a close second, but service must come first, and if it does not the operator should get out of the public service business. Safety is in reality a function of service. Good service implies safe methods, but this does not mean that safety must take the place of service, for all the operations of a public service corporation entail some risk. We should secure a proper balance and not be carried away by the hysterical cry of 'safety first' regardless of anything else which the present campaign implies.

"If 'safety first' were really lived up to, how would it be possible to operate steam boilers at 200 lb. pressure, an amount allowed under certain conditions? Should not this be cut down to 100 lb., since we know that high-pressure boilers have exploded and the best of tubes have blown out? 'Reasonably safe' says operate the boilers at 200 lb. 'Safety first' says you must not do it. Your steam piping may break at a joint and scald an employee. In the face of this, however, 'Good engineering' says, 'I have used my years of experience and well-proved theories and also a factor of safety in the design of the piping.' But 'Safety first,' with an 'I-told-you-so' air, responds, 'Accidents will happen; you should have put your steam pipe 50 ft. underground or up in the air 100 ft. where no one could have been burned.' The engine may run away and the flywheel may burst. 'Safety first' prescribes a casing or an inclosure strong enough to hold the flying fragments. 'Service first' knows that it is ridiculous and says, 'Take a chance, but use reasonable precautions to see that your governor is kept in perfect condition and be sure to put on a reliable safety stop so that you will be reasonably certain that your governor will not overspeed.' Your dynamo turns out current at 10,000 volts. 'Intelligent handling,' says this is a safe voltage; 1000 volts, however, is less liable to cause an accident, and 'Safety first,' to live up to its name, orders a reduction. 'Service first' says no, and as 'Service first' is the final consideration the plant keeps on operating at 10,000 volts.

"A proposed code of safety rules says, 'Do not work on any circuit while it is alive.' That is 'safety first' with a vengeance, for under present-day demands it is impossible," says Mr. Blood. "Modern requirements make it necessary that we take some chances; this doesn't mean that carelessness is ever justified, but rather that all the precautions that are reasonably necessary must be taken and also that we must 'deliver the goods,' which in this case is 'service.'

"The great American public says, 'The electric current must be ready for us every minute of the twenty-four hours in every day of the year; when we push the switch the lights must shine instantly.' The trolley car is scheduled to run every five minutes and it must do so. A minute or two late will not be satisfactory. Service is the demand first, last and all the time; service the public is entitled to and service it will get. Safety is necessarily of secondary importance. Suppose Lord Kitchener gave the order to advance and his officers should say, 'Tut, tut, General; remember safety first.' What would such an army accomplish? 'Safety last' must be inborn in a good soldier. 'Service first' is the prime requisite of a good soldier, and in all enterprises where personal achievements count 'service first' must be the universal guide."

Coal and Its Economical Use

The advisability of generating electricity as a by-product of coal, selection and testing of fuel, characteristics of bituminous coal, principles and control of combustion, classification of heat losses, effect of carbon dioxide on boiler efficiency and the final temperature of the exit gases were discussed recently by Mr. P. S. Thompson before the Newcastle Section of the (British) Institution of Electrical Engineers. The author presented an economic argument for the combined production of coke, gas and electricity.

Some of the factors governing the choice of fuel are: price delivered at the generating station; the heat equivalent; suitability to the furnaces in which it will be burned; amount of ash which will be produced and the cost of its disposal. In placing fuel contracts it is advisable to have laboratory fuel tests supplemented by data obtained from actual boiler evaporative trials. It was pointed out that purchasing coal on the calorific-value basis with bonuses or rebates for changes in composition tempts coal dealers to increase their unit price. There is, however, no question as to the value of making systematic analyses of coal as the knowledge that such is done has a marked effect in keeping the quality of deliveries up to standard. It is the amount of shale and dirt present in coal which is responsible for variations in the calorific value. Unless sampling is carefully carried out, the most accurate tests are of little value.

The amount of volatile matter, which depends upon the hydrogen contents of the coal, may be looked upon as a measure of the difficulty of burning without smoke, and when this amount rises to 30 per cent or more the difficulty is very considerable. An excess of volatile matter is also undesirable as it exists at the expense of the fixed carbon, which is the more valuable heating agent. If iron pyrites exist in the coal, sulphurous gas will be formed during combustion and will eventually become sulphuric acid, which is very detrimental to metallic surfaces. Furthermore, sulphur causes pasty clinkers which interfere with the draft, therefore coal containing more than 1 per cent of sulphur should be avoided.

Rapidity of combustion depends upon the exposed surface of the combustible. Furthermore, the temperature of the fire depends on the rate of heat evolution. The theoretical maximum attainable temperature when carbon is burned to carbon dioxide is 3700 deg. Fahr., and when burned to carbon monoxide is 2330 deg. Fahr. In practice, however, the air supply cannot be so closely regulated that the theoretical temperature is ever attained. If 25 per cent excess air is furnished, the maximum temperature obtainable will be 3540 deg. Fahr. It should be remembered that the reduction of carbon dioxide to carbon monoxide is a heat-absorbing reaction.

As bituminous coal must be burned partly as a gas and partly as a solid, the furnace must be designed for two dissimilar conditions. These conditions are met by providing a large combustion chamber lined with refractory material so constructed that the gases are

not brought into contact with the absorbing surfaces of the boiler before combustion is complete, otherwise smoke will result.

With perfect combustion the flaming gases should be transparent, and the furnace brickwork fairly visible and of a whitish-red color. For proper inspection a violet-blue glass should be employed. Through this the gases and fuel will appear lavender-gray if combustion is perfect; if not, the flames will look like streams of dark-colored gas.

Complete combustion is not necessarily economical, for if excess air is present it will carry away a large amount of heat. To maintain a satisfactory natural draft the temperature of the exit gases from the furnace should be between 400 deg. and 550 deg. Fahr. With these temperatures, however, 11 per cent of the total heat given off by the fuel escapes through the chimney, so that it may pay to install a forced-draft system. The temperature of the exit gases cannot be taken always as a measure of the boiler and furnace efficiency as excess air will cause the temperature to decrease and dirty heating surfaces will allow the gases to pass away uncooled.

When bituminous coal is burned the hydrogen of the hydro-carbon gases takes up oxygen to form water; therefore the theoretical amount of carbon dioxide produced with perfect combustion is 15 per cent instead of 18 or 19 per cent. Hence the excess air for the best operation should be about one and one-quarter times the theoretical value. As the presence of 1 per cent carbon monoxide in the exit gases corresponds to a loss of 2.2 per cent of the total heat from the coal, it is better to run below 12 per cent carbon dioxide than above.

When coal is burned in a furnace the heat produced may be considered as being distributed as follows: Radiation loss, which averages 5 to 7 per cent in modern boiler setting; heat carried away by exit gases, part of which in natural-draft installation must be regarded as the cost of producing the draft; the heat lost, or rather not evolved, owing to imperfect combustion; the loss due to unburned carbon being carried away in ash and clinkers, about 5 per cent on the average, and the heat absorbed by the heating surfaces. The amount of heat absorbed by the water is increased by a reduction of the first four items. As the first depends upon the construction of the boiler and is therefore out of control of the operator, the effective utilization of heat can be obtained only by adjusting the fuel and the air supply so that the best relationship will exist.

Starting Small Gas Engines

In small gas or gasoline-engine-driven plants employees frequently expose themselves to considerable danger in starting engines by standing on the flywheel spokes or by thrusting levers between the spokes and prying the flywheel over until an explosion occurs. Such practices should be prohibited and safer methods recommended. A safety crank much favored in Germany was described in the December issue of the *Travelers' Standard*. Besides disengaging when the engine starts this crank is designed to throw out automatically if the engine "back-fires" or the operator releases his grip on the handle. Engines rated at 6 hp to 15 hp may be started safely by opening the ignition circuit, turning the flywheel until a charge of explosive mixture is drawn into the cylinder, then closing the ignition circuit and turning the wheel back against compression. When safety can be assured by the use of mechanical devices of this kind, there is certainly no excuse for employees running the risk inherent in crude methods such as those alluded to.

Questions and Answers

Size of Oil Grooves in Bearings

What is the usual size of the oil grooves cut in bearings? W. H. P.

The size depends somewhat on the diameter of the bearing, but ordinarily the width is from 3/32 in. to ¼ in. and the depth is ⅛ in. or slightly less.

Protecting Pole Butts

What method is there of preventing pole decay at the ground line besides impregnating the wood with a preservative? K. E. W.

Pole rot at the ground line is being prevented by a number of companies by incasing the butt with concrete from several inches above the ground line to about 20 in. below the surface. By sloping the top of the concrete shell away from the pole an effectual watershed is formed. Provided that the earth around the lower part of the pole is properly tamped, the setting described will be practically as good as an all-concrete butt, and it is considerably less expensive. The shell should have the same diameter as the hole excavated for the butt to furnish a substantial footing for the pole.

Quantity of Gas Required per Kilowatt-Hour

In sinking a well at our generating station we accidentally opened a natural-gas supply which yields about 50,000 cu. ft. a day. Is this amount sufficient for generating steam for a day load of about 50 hp? Kindly furnish us with any data on gas-fired boilers. S. H.

Not knowing the heat equivalent of the gas you obtain or the efficiency of your plant, it is impossible to make any definite statements. In a station at Hot Springs, Ark., however, where gas containing 850 lb.-Fahr. units is available the company is generating about 1 kw-hr. on 50 cu. ft. of gas. About 1 lb. of steam at 175-lb. pressure is generated with 1.54 cu. ft. of gas. Four 316-hp Heine boilers, each equipped with eleven Gwynn burners, are employed. Electricity is generated by two turbine-driven units rated at 1000 kw and 1250 kw respectively. The ratio of the kilowatt-hours generated to the kilowatt-hours which could be developed by the apparatus operating was 55 per cent; the ratio of the kilowatt-hours generated to the boiler-horse-power-hours developed was 80 per cent, and the station load-factor was 24 per cent.

Effective Area of Chimney

What is meant by the effective area of a chimney? How does it bear on the question of size of chimney? E. K. S.

The effective area of a chimney is the area of that part of the cross-section which is assumed to be active in carrying off the waste gases. The velocity of flow of the hot gases is not uniform over the whole cross-sectional area of the chimney. It is greatest at the center and least at the outer boundary of the section; that is, the friction against the inside walls of the chimney produces a retardation of the flow. This retardation has the effect of reducing the capacity of the chimney; therefore, to make allowance for such reduction, the actual area of the cross-section is made somewhat greater than the area that would be required if all parts were equally effective. To be on the safe side, the retardation of flow is assumed to have the same effect on the capacity as the rendering inactive of a strip 2 in. wide just inside the inner wall of the chimney. In determining the size of a chimney, then, the effective area required is found by a suitable formula, and from

it the diameter of an equivalent circle or the side of an equivalent square is calculated, according as the chimney is to be square or round. The diameter or the length of side thus obtained is increased by 4 in. to allow for the assumed 2-in. inactive strip all around, and the sum is the actual inside diameter or length of side of the chimney.

Wire Stringing

Please describe some machine which can be used satisfactorily to string line wires taut. H. E. D.

An electric-service company in the Middle West has been stringing wires satisfactorily by winding the pulling-in rope around a portable motor-driven drum while linemen attach the conductors to their respective insulators with tie wires. The drum is connected with the motor by a belt and reduction gears so that the line wire will not be drawn in too rapidly and so the belt will slip if the tension becomes too great. With this equipment two or more long stretches of wire can be installed simultaneously by very few men. The equipment is carried on a horse truck. Flexible conductors are employed to convey energy from nearby trolley wires or service lines to the motor. If the wire puller is installed on an electric truck, the motor can be operated on storage-battery energy.

Difference Between Foaming and Priming

Is there any difference between foaming and priming in a boiler? Both terms seem to be used in the same sense. C. H. B.

There is a difference. Foaming is the formation of froth or foam at the surface of the water during boiling and is due to dirty feed water. Priming is the carrying over of water from the boiler into the steam pipe with the steam and is caused by violent ebullition and the too rapid withdrawal of steam from the boiler. The violent boiling throws up the water into the steam space and the water particles are entrained by the outflowing steam and so carried along to the outlet. Foaming can occur while the stop-valve is closed, but priming can occur only when the stop-valve is open and steam is being taken from the boiler. Very often, foaming and priming occur at the same time, which may account for the words being used in the same sense.

Quality of Steam

Please explain what the quality of steam means. F. R. S.

The expression "quality of steam" denotes the percentage of dry saturated steam in a mixture of steam and moisture. The steam produced by a boiler that has no superheating surface is never dry saturated steam, but always carries some unevaporated water in the form of moisture globules. The ratio of the weight of dry saturated steam in the mixture to the weight of the whole mixture is the quality of the steam; thus, if the quality of the steam is stated to be 97 per cent, the meaning is that 97 per cent of the mixture is dry saturated steam and the remaining 3 per cent is unevaporated moisture having the same temperature as the steam.

Cable Protection

What is a good fire-resisting covering for cables? Also describe method of applying it. P. C.

Portland-cement mortar has been employed satisfactorily by some companies to protect cables in exposed places such as in manholes, around switchboards and in station cable runs. This covering, besides being strong and inexpensive, is fire-resisting. It has been reported that this material has prevented interruption to service supplied through lead-covered cables which have been exposed to manhole fires. Although heat melted the lead sheath frequently, the cement remained intact and protected the insulation. Before applying the mortar the cable to be protected should be wrapped with rope or cordage wound spirally with a pitch of about 0.75 in. The mortar may then be applied by hand and finished with a quarter-round trowel to a thickness of 0.5 in. The cement should be kept moist for the first two or three days.

Purpose and Calculation of Engine Constants

Why are engine constants used? How are they found? W. D.

Engine constants are used in working up the results of an engine test from the indicator diagrams, and their object is to save time and labor. The horse-power of an engine is found by the formula $PLAN \div 33{,}000$. But the length of stroke L and the area A of the piston do not change; and if the engine runs at constant speed during the test, the number of strokes N does not change. Therefore, the part $LAN \div 33{,}000$ of the formula has a constant value which may be designated by C_1. This value C_1 is then the engine constant for the engine at the particular speed indicated by the value of N used in calculating the constant. The horse-power of the engine is then simply PC_1; that is, it is the product of the mean effective pressure and the engine constant. If the engine speed varies during the test, the part $LA \div 33{,}000$ of the formula is constant in value and may be represented by C_2, which becomes the engine constant for variable speed. The horse-power is then PNC_2.

Overheating of Field Coils

What causes the field coils on a generator to become hot even when the machine is not carrying a load? M. F. H.

Excessive heating of the field coils under the condition cited may be caused by excessive field current, eddy currents in the pole pieces, or moisture in the coils. To determine the cause apply the normal exciting voltage to the coils when the machine is not operating. If the temperature rises by more than 50 deg. C. above the room temperature, there may be either excessive current in the coils or moisture in the insulation. The last-mentioned condition can be detected by the appearance of vapor or by the feeling of moisture. Wet insulation may be dried by heating for several hours in oil under a vacuum, but not at such a temperature as to injure the insulation. Sometimes the moisture can be driven off without removing the coil by allowing less than the rated current to flow through the coil for several hours. If the heating be caused by excessive current in the field conductors, it will be necessary either to operate the generator at lower voltage or else to wind a few more turns of wire around each pole so that the current can be decreased without decreasing the flux. A wholly or partially short-circuited field coil may also produce excessive current; the defective coil can be detected by its being cooler than the other coils and by the pole piece being weaker magnetically than the others. When in doubt regarding the integrity of the field coils it is advisable to measure the resistance to determine if they are nearly equal. If the difference is considerable (more than 5 per cent), it is safe to assume that one coil is short-circuited or grounded in two places. Heating of the pole pieces from eddy currents is usually caused by faulty design or by fluctuations in the current. The current produced by open-coil generators used for arc lighting is decidedly pulsating in character and may therefore cause this trouble.

COMMERCIAL SECTION

Cheap-Residence Wiring Campaign

The Lehigh Valley Light & Power Company has recently launched throughout its territory an extensive flat-rate and old-house-wiring campaign, many features of which may prove to be of valuable assistance to other central-station companies operating under similar conditions.

TABLE I—OLD-HOUSE-WIRING SCHEDULE

Rooms	Outlets	Price
4	4	$12.50
5	5	15.70
6	6	17.45
7	7	19.10
8	8	20.80
9	9	22.50
10	10	24.20
11	11	25.95
12	12	27.75
13	13	29.40
14	14	31.20
15	15	32.90
16	16	34.50
17	17	36.50
18	18	38.50
19	19	40.50
20	20	42.50

All wiring concealed, including service wires and meter loop. Inspection extra. For all over twelve lamps add $2 for extra cut-out and circuit; for all over twenty lamps add $1.50 per outlet. Snap switch, $0.75. Flush switch, $1. One pair three-way switches, $6. One pair four-way switches, $10. Porch ball, complete, including flush switch inside, $6. Cellar outlet, complete with snap switch at head of stairs, $3.25. Insulating joints, to be used where gas piping is installed, 30 cents.

This company supplies energy throughout about 500 sq. miles of one of the most thickly populated industrial and agricultural sections in the country. The main offices and salesrooms are in Allentown, Pa., with branches in Bethlehem, South Bethlehem, Catasauqua and Slatington. By reason of the nature of the industries upon which the above communities thrive, such as iron, steel and cement mills, shoe, textile, slate and automobile factories, and the inherent characteristics of the agricultural population in the rural districts, it was realized that a very large and profitable load lay within

TABLE II—OPEN WIRING—CLEAR WORK ONLY

Outlets	Price
1	$5.00
2	6.25
3	7.50
4	8.75
5	10.00
6	11.25
7	12.50
8	13.75
9	15.00
10	16.25

Including drop cord, key socket, meter board, service wires, cut-out, fuse box and inspection. For all over ten outlets, add $1.25 per outlet; for all over twelve outlets, add $2 per extra cut-out.

the range of acquisition provided that equitable arrangements could be made which would prove mutually attractive to the company and to the prospective consumer.

The particular objective of this campaign is the thrifty native or foreign-born families, to whom the idea of good illumination is not so important as the item of cost connected with the lighting. Prospective customers of this type, while usually realizing the manifold advantages of electric lighting, must of necessity stretch each dollar of their income to the elastic limit. Therefore, the idea of a kilowatt-hour charge does not appeal to them as they cannot be sure that their monthly bill will fall within the financial provisions made for this item of household expense.

On investigation, it has been found that for the average consumer of this type 100 watts would supply the lighting requirements by a considerable margin, and from records of revenue obtained from existing cus-

Form L. 36

FLAT RATE CONTRACT.

(RESIDENTIAL LIGHTING)

NO.

THIS AGREEMENT, made and entered into this ..... day of ..... 191..... by and between the LEHIGH VALLEY LIGHT AND POWER COMPANY, hereafter referred to as the Company, and ..... hereafter referred to as the Consumer, WITNESSETH:

The Company agrees to furnish the Consumer Electric Current for lighting only upon the premises No. ..... or elsewhere on the Company's lighting lines, and further agrees to install an excess indicator to limit the consumption to ..... Watts at any one time.

Subject to the terms and conditions endorsed hereon, and on the back hereof, which are hereby made a part of this agreement, during the term of two years beginning the day excess indicator is installed, the Consumer agrees to pay for the use of said current in the quantity and manner above noted, the sum of $ ..... per year, payable in instalments monthly in advance, of $ ..... subject to a discount of 10 per cent. if paid at the office of the Company on or before the 15th day of the month for which bill is rendered, providing no amount on any prior bill remains unpaid.

The Consumer agrees to equip his premises with Tungsten lamps only, and not to install or permit the installation of incandescent lamps of any other type, or any other current consuming device on the Company's circuits, without first receiving the written assent of the Company.

The Consumer hereby expressly authorizes and empowers the Company to remove its fixtures and all other property belonging to the Company, and to cut off the supply of electric current whenever any bills for lighting are in arrears for a period of 20 days, or upon violation by the Consumer of any of the terms and conditions of this agreement.

In case of the removal of the Company's fixtures or other property or the failure of the consumer to comply with the terms and conditions of this contract there shall then become due as liquidated damages and not as a penalty, the amount specified above for the period of the two years less any amounts already paid on account of this contract.

Accepted ..... 191.....

Lehigh Valley Light and Power Company.

By .....

Signed .....

by .....

Solicitor .....

No agent has power to make, modify, or alter this agreement, or waive any of its conditions or to bind the Company by making any promise or by accepting any representation or information not contained in the agreement.

CONTRACT FORM

tomers of the same class a flat rate of $1 per month would supply a fair return on the investment provided that some additional item of income, proportional to the energy actually used, could be so introduced as to take care automatically of the unreasonable twenty-four-hour use of the maximum power possible under this arrangement. This point has been covered by prohibiting the use of any energy-consuming devices except tungsten lamps.

The instrument used for controlling these flat-rate

TABLE III—CAMPAIGN FIXTURES

No. 1—Three-light fixture with pull-chain sockets	$3.70
No. 2—Two-light fixture with pull-chain sockets	3.10
No. 3—One-light pendant	1.60
No. 4—One-light bracket	1.00
No. 5—One-light ceiling ball	1.00
No. 6—Three-light shower	5.25
No. 7—One-light semi-indirect bowl	8.00

Including ceiling mats and hanging. Insulating joints, 35 cents each extra. Porch ball, including wiring and flush switch, installed, $5. Drop cord, 75 cents.

installations is the "excess indicator" of the type which alternately opens and closes the circuit when the customer's demand exceeds the wattage specified in the contract.

The table of rates to cover all classes of lighting service included in the campaign is as follows per watt of demand per month: 1.11 cents for residence and short-hour use; 1.66 cents for stores, etc., closing not later than 9 p.m.; 2.22 cents for drug stores, saloons, etc., closing not later than 12 midnight; 2.77 cents for establishments open all night. These rates are subject to a 10 per cent discount if paid before the fifteenth of the month for which the bill is rendered. The details of the actual contract subscribed to by the consumer are shown in the accompanying illustration.

The great majority of buildings in which tenants are being reached by this campaign are not wired. Hence, in order to attract the maximum number of prospective customers, an agreement was reached with the electrical contractors by which all accepted a predetermined scale of charges as shown in Tables I, II and III. Ten

months' time payments, or 10 per cent discount for cash, is allowed to the consumer. Unless the contractor wishes to carry the instalments and earn the 10 per cent additional himself, he is paid the established charges less 10 per cent in thirty days by the company, and the latter attends to the customers' time payments.

To all prospective customers are sent illustrated circulars describing in simple terms the absence of mutilation to the building and discomfort to the residents in wiring existing houses and calling attention to the advantages of the modern tungsten lamps. After the necessary period of time needed to digest this literature, salesmen follow to close the contract by personal solicitation. Ten salesmen are being employed to bring this campaign to a successful conclusion.

The company effected the wiring of 400 old houses in the eleven months preceding this campaign and expects 1500 more to be added in the next twelve months.

A Novel Electric Sign

A distinctive electrically illuminated sign, and one that cannot fail to attract the favorable attention of the passer-by, day or night, has recently been erected by the Texas Company on one of its buildings at Port Arthur, Tex.

The building is the one in which the motor oils are filtered. In one end of the building are bins, roasting furnaces and other apparatus for drying and recovering the material used as the filtering agent, and in the other end are the filters and receiving tanks. The central portion, which is separated from either end, is used for the motor-driven pumps which handle the oil before and after filtering.

The wording of the sign as shown in the accompanying illustration is "The Texas Company." The sign consists of fifteen 9-ft. letters painted white, forming an attractive sign by day, while at night it is made considerably more attractive by reason of the unusual illumination afforded. This is of a pea-green color and is obtained from mercury-vapor lamps placed behind a reflector located in front of the sign. The characteristic color of the illuminant makes the sign distinctive and leaves a pleasing impression on the passer-by whose attention it never fails to get.

In addition, the trade-mark of the Texas company is a red star and green T, the T being in the center of the star, and all of the packages of oil, in addition to carrying this trade-mark, have a body color of pale green, which is quite closely approximated by the color of the illumination, therefore making it particularly appropriate.

The sign is 155 ft. 10 in. long, has a height of 9 ft. 2 in. and is supported by a substantial iron framework. The height above the top of the building is over 9 ft., thus making it easily visible over the surrounding country.

The light is furnished by sixteen Cooper Hewitt lamps mounted in iron boxes placed 11 ft. in front of the sign.

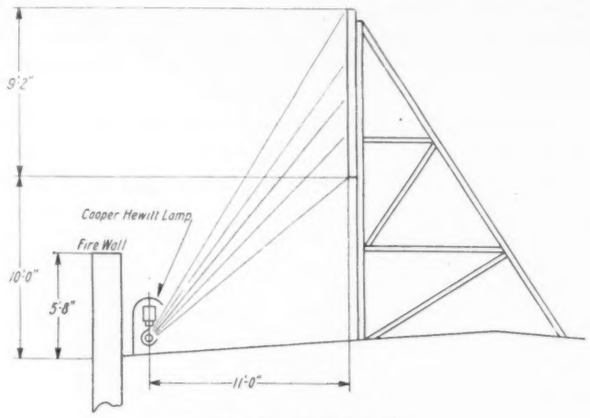


FIG. 2—LAMP BOX

These boxes are of particular interest, being made of corrugated-iron top and sides with a glass face just large enough to accommodate the lamp. A special reflector placed just beneath the tube of the lamp throws the light directly against the face of the sign.

The lamps are operated four in series on a 240-volt direct-current circuit, supplied by the company's own plant and taking 3.5 amp in each circuit, or 192.5 watts per lamp. The total power consumption for the installation is approximately 3 kw, the sign being very economical as well as attractive.

Determining Average Life of Gas-Filled Lamps

At present practically all tungsten gas-filled lamps are sold under a guarantee of 1000 hours' average life, which means that in a consignment of any specified number of lamps the average life of the lot will be 1000 hours. As a purchaser of a considerable quantity of these lamps the city of Chicago has had to devise a means of determining the life of its new lamps. To keep life data on all lamps was thought to be too expensive, so 15 per cent of the lamps purchased are considered test lamps, and upon the performance of these units accurate records are kept.

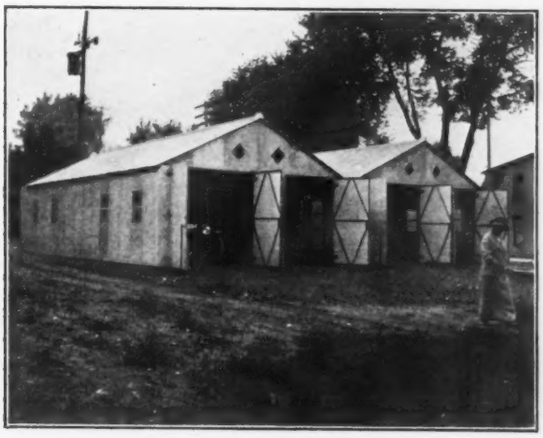
Such test lamps are divided equally among the circuits in order that the electrical conditions can be considered average. The locations for the test lamps are selected from circuit diagrams in the office, assuring that no

FIG. 1—TEXAS COMPANY'S SIGN BY NIGHT

prejudice may enter to place test lamps under favorable or unfavorable local conditions. When circuits are first put into operation there are sometimes a few lamps which fail immediately. The units which thus fail are then replaced, and if any of these happen to be test lamps the failure is not included in the life test, for lamps which fail immediately are considered to be defective. With this exception, however, the average life of the test lamps is taken as the life of the total number.

1296 Sq. Ft. of Garage Space for $1,100

One of the necessary adjuncts to every modern central station is a garage for housing motor vehicles, which to a large extent are replacing horse-drawn wagons in every department of electric-service companies. Good judgment, aided and abetted oftentimes by mandatory city ordinances, dictates that these buildings shall be of fireproof construction. First-class fireproof buildings, however, are generally expensive, and their prohibitive cost frequently leads to renting garage space at high prices.



ELECTRIC COMPANY'S GARAGE

A solution of this high-cost dilemma has been reached by the Commonwealth Power Company at Jackson, Mich., where two new garages each measuring 18 ft. by 36 ft. at the ground line have been erected. These buildings are constructed of No. 26 gage non-corrosive metal spot-welded to angle-iron framing. Each is provided with six wire-glass windows along the sides and the ends are formed by double swinging doors. Ventilators in the gables keep the air pure and cool inside, even when all doors and windows are closed, and it is said that, contrary to expectations, the buildings did not prove excessively hot during the summer months.

Exclusive of the grading and filling to secure a level and high earth floor, the total cost of these garages as they stand was $1,100. The lot on which the garages have been erected is just in the rear of the company's main office, and machines of the company's employees are often parked here indoors rather than along the curb before the office.

Co-operation Between Contractor and Central Station

One obstacle which has blocked the contractor's way to success, said Mr. J. L. White before the recent convention of the Oregon Electrical Contractors' Association, has been the competition received from central stations which do wiring and which give away, or sell below cost, energy-consuming devices. "Electric wiring and contracting is a business in itself, and I do not believe that the average central station can handle wiring contracts or sell appliances as satisfactorily as can a contractor or dealer," continued Mr. White. "The general public is skeptical of any article the central station may sell, fearing that such contrivances will use the maximum amount of energy and not the minimum. The majority of people cannot see why the central station should want to recommend devices which use the least amount of energy when it is the company's business to sell energy."

In the scheme of co-operation between contractor and company each should endeavor to adjust complaints made against the other. It frequently happens that the contractor or the central-station company is in a position to adjust a complaint or to remove the antipathy arising from some real or fancied grievance against the other.

As to the part which the central station should play in this co-operative relationship with the contractor, the speaker suggested: First, a trained sales force working with the contractor in stimulating demand for energy-consuming devices; second, no direct sales by the company, and, third, frequent conferences with the contractor concerning new possibilities for the extension of the use of energy.

Attracting Attention to Property with Gas-Filled Lamps

By pointing out that the intrinsic brilliancy of gas-filled lamps attracts attention the Edison Electric Illuminating Company of Brooklyn, N. Y., has induced a number of real estate owners to install these lamps on property which is to be sold or leased. In the illustration published herewith is shown an installation of sixteen 500-watt lamps which are arranged along the cornice of a one-story building to make it more attractive for renting. Light from these lamps can be seen several blocks away and besides attracting attention to the buildings considerably improves the value of the property by brilliantly lighting the street below.

GAS-FILLED LAMPS ATTRACT ATTENTION TO PROPERTY

The Results of Christmas Campaigns

Another holiday season has come and gone, and since then enough time has elapsed for every sales manager to reckon up the total number of electric appliances sold and the additional connected load secured thereby. The amount of the gross sales and the net profits have been figured out to the last Lincoln penny, and in every electrical store, be it owned by jobber, central station or contractor, there is known what was accomplished financially by the Christmas sales. Practically everywhere reports indicate that Christmas campaigns were successes of a kind highly gratifying to the promoters.

Some places, however, have more than the immediate commercial success to report. They grasped the holiday opportunity to do things which not only brought patronage to their doors during the Christmas season, but also placed the company before the public in a new rôle—the rôle of a commercial enterprise with a heart. In different cities and towns the companies took various methods of exhibiting their good wishes toward the community, but the evident success of one of these plans—the community Christmas—has been too marked to escape attention. As typical of this condition it seems fitting to quote a letter written to the new-business manager of a central-station company in an Ohio city by the board of directors of the city's improvement association, composed of leading business men:

"Dear Mr. Blank:—This may seem a tardy acknowledgment of all that you did in connection with the community Christmas, but our directors did not meet holiday week, and Jan. 5 was the date of their first meeting this year. At this meeting a unanimous and most sincere vote of thanks to you was made a matter of record in recognition of your splendid services. As a rule such action is more or less formal, and frequently it does not mean very much, but I want to assure you that in this case what you did appealed to our directors in a way that is most unusual. They understand fully and realize the great sacrifice that you must have made of your own time, and possibly that of your company, and know that your community Christmas work must have seriously interfered with your private affairs and your business. We are therefore all the more grateful to you for taking hold of what was naturally a difficult matter to handle, putting it through in a way that has pleased everybody. If there has been a single 'comeback' anywhere along the line, it has entirely failed to reach us."

The municipal Christmas in the city from which this letter came cost the city in 1913 approximately $500. The community Christmas of 1914 cost the city nothing. It was the qualities of salesmanship and efficient management which applied to the organization of the 1914 festival accounted for the difference.

Securing Increased Load with Nitrogen Lamps at Cincinnati

For a number of months the Union Gas & Electric Company of Cincinnati, Ohio, has been conducting a campaign to replace gas "arcs" with electrical illuminants. To this end the commercial department of the company offered to install and maintain free of charge in customers' premises 400-watt, 500-watt and 750-watt tungsten lamps of the vacuum type, the energy consumed being metered and charged for at the regular rates.

With the advent of the new nitrogen-filled lamps these high-efficiency units were substituted for the vacuum-type lamps.

From the first the 1000-watt size gave excellent satisfaction with respect to life and quantity and quality of light, according to Mr. W. A. Wadsworth, of the commercial department of the company. The 750-watt lamp, however, did not prove so satisfactory, giving trouble from early burn-outs.

Fixture with Adaptations for Nitrogen-Lamp Use

The fixture used consisted of a solid-bronze ventilated housing and a white enameled reflector, fitted with a 12-in. ball globe with a 1-in. opening at the bottom. On account of the intense heat generated by the nitrogen lamps, it has been found necessary to use a baked porcelain enameled reflector, as no paint would stand the high temperature. Special attention also had to be given to the ventilation of the unit in order to maintain the temperature within reasonable limits. This fixture has proved suitable for both outdoor and indoor use.

These 750-watt and 1000-watt units find their application principally among long-hour burners, particularly theaters, picture shows, restaurants, drug stores, etc.

Following the introduction of the two larger sizes of nitrogen lamps, as soon as the 400-watt and 500-watt lamps came out the question arose as to what attitude should be taken in regard to these sizes. It was found that, owing to the cost of these lamps and their uncertain life, it was very questionable whether or not the unit could be put out and maintained without charge and be a paying investment. These sizes were, therefore, not accepted, but the company continued to put out 500-watt tungsten lamps until early fall.

When the 200-watt and 300-watt nitrogen lamps were available, the question arose again as to what attitude should be taken in regard to these sizes. It was decided to prepare a unit suitable for the 300-watt lamp and to install it complete, the cost to be made as low as possible, and to abandon for the present the use of 400-watt and 500-watt lamps, both of the tungsten and nitrogen types, but to continue placing and maintaining without charge 750-watt and 1000-watt units.

LOAD INCREASE AND ESTIMATED REVENUE DUE TO NITROGEN LAMPS

Size Lamp	No. on Lines	Kw Increase in Load	Hours Day*	Days Year*	Kw-hr. Year*	Rate, Cents per Kw-hr.	Estimated Income		
							Per Lamp	Per Kw	Total
300-watt	337	55	4	300	360	5	$18 00	$60	$6,066
750-watt	434	350	4	300	900	4½	40 50	54	19,602
1000-watt	278	250	4	350	1,400	3½	50 00	50	13,900
Total	1,099	655	.....	.....	.....	.....	.....	.....	$39,568

*Estimated.

Campaign on 300-Watt Units

After considerable experimenting a unit consisting of either a ceiling or pendent-type fixture, wired complete with suitable reflector and lamp and, if necessary, pull-chain switch, was obtained. This could be installed at cost for $5. Samples of this fixture in both types, with lamps, extension cords, plugs and sockets and suitable literature, were placed in cases and given to the salesmen with instructions to take orders for these units, which would be placed on thirty days' trial or would be sold on terms of $1 down and $1 per month when desired. The salesmen were further instructed to concentrate their efforts among gas users and long-hour burners.

The campaign did not get under way until Oct. 15, and this, plus business conditions, did not permit of the results expected. However, by Jan. 1 337 units had been placed. About one-third had been trial installations, and more than 90 per cent of these were retained.

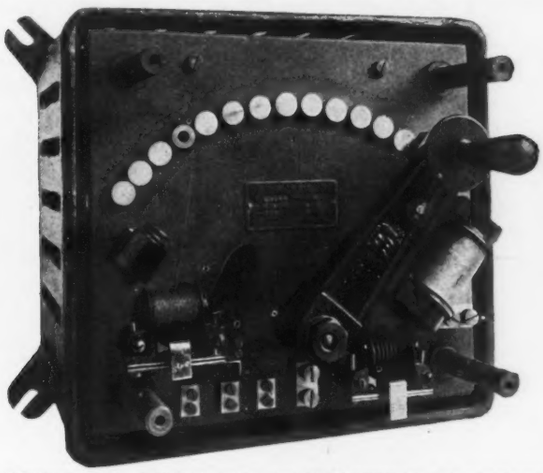
In order to determine the life of the 300-watt lamps, a record has been kept showing the number of days each burned-out lamp had been in operation. This record to Jan. 1 showed twenty burn-outs. Three burned one day, one two days, two four days, one seven days, three eleven days, two thirteen days, one twenty days, and one twenty-eight days. The other six burned a month or more.

The accompanying table shows the results to Jan. 1 of the nitrogen lamps on the company's lines.

NEW APPARATUS AND APPLIANCES

Ground Protection for Motors

The General Electric Company, Ltd., London, Eng., has recently placed on the market an attachment for direct-current motor starters, known as Jowers' leakage device. This device prevents the grounding of a motor's windings to open the main circuit-breakers and shut down all other motors on the same line. A low-

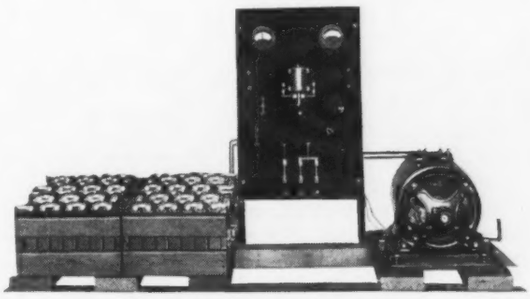


DEVICE FOR PREVENTION OF GROUNDING OF MOTORS

resistance trip coil inserted in a lead from the motor frame to the ground is employed. If a ground occurs while the motor is running, the flow of energy through the leakage coil will cause it to operate a device short-circuiting the low-voltage coil, thereby causing the starter to tip and shut down the motor. If an attempt is made to start the motor while a ground exists, the flow of energy through the leakage coil actuates a catch which operates in a way to render impossible further movement of the starting arm.

Gasoline-Electric Lighting Outfit

A gasoline-electric lighting outfit for use in country and suburban homes where little attention can be given to the plant is shown in the accompanying illustration. An automatic circuit-breaker is provided for automatically closing the battery-charging circuit the instant that



SMALL LIGHTING SET

the dynamo has built up sufficient voltage to charge. This circuit-breaker also automatically disconnects the circuit whenever the dynamo voltage drops too low to charge the battery. An automatic cut-out is provided to stop the engine and dynamo when the battery becomes fully charged or to cut off the battery at such a time without shutting down the engine. To notify the operators when the batteries are discharged an electric buzzer operated by a magnetically operated relay controller is employed. These plants are designed to supply energy for lighting from the battery alone or from dynamo and battery operating in parallel. The plants can, however, be supplied to operate in any manner desired by the purchaser. The starting of the dynamo and the adjustment of the engine to proper speed is claimed to be all the attention required. The resistances are all accurately adjusted at the factory, and there is no necessity for their being adjusted by the operator during the period of charging. These sets are built for 30 volts and 110 volts and in various sizes requiring from 2-hp to 5-hp engines. They are manufactured by the Suburban Lighting & Gas Engine Company, corner Summit and Lagrange Streets, Toledo, Ohio.

Loom Clamp

The accompanying illustration shows a loom clamp recently placed on the market by the Machen & Mayer Electric Manufacturing Company, Philadelphia, Pa. This device is said to provide a strong, economical means of fastening all sizes of loom to all sizes of knock-

LOOM CLAMP

out holes, and it is claimed to be superior to the bushings commonly employed. The clamp illustrated is designed for two loom-covered conductors, which are held fast on either side of the tightening bolt provided in the center.

Motor-Driven Mine Pump

In the accompanying illustration is shown a group of motor-driven pumps designed for use in coal mines. The pumps are equipped with brass-lined water cylin-

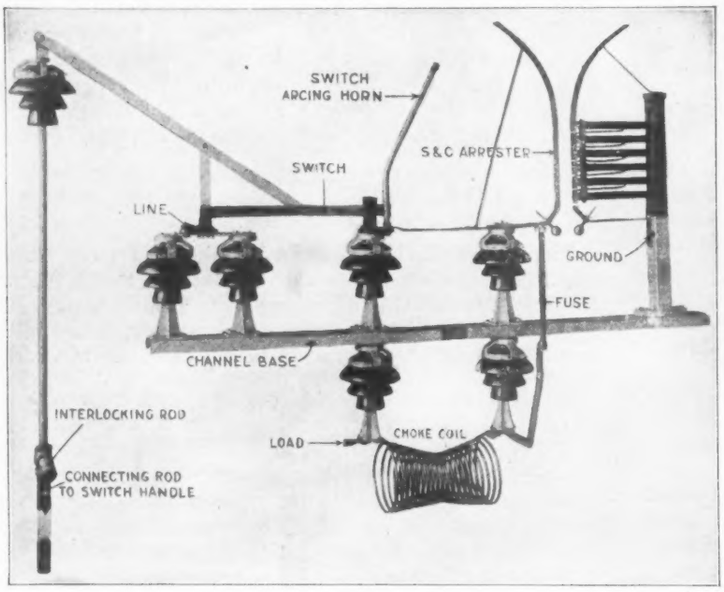
ELECTRIC PUMPS FOR MINES

ders, tobin-bronze piston rods, and bronze valve seats, stems, springs, stuffing-box caps and glands, so that they are thoroughly protected against the action of mine water. A direct-current motor is mounted on the top of the pump, and the windings are impregnated to protect them from dampness. Automatic control is provided so that the pumps can be started and stopped from any convenient point. The motor and pump may be

mounted on a truck for moving from place to place if desired. The Weinman Pump Manufacturing Company, Columbus, Ohio, is manufacturing these pumps, and Westinghouse motors are employed to operate them.

Outdoor Substation Switching and Protective Units

On account of the successful commercial operation of low-cost, high-tension outdoor substations with comparatively small ratings, a field for equipment with higher ratings has been developed. To meet these conditions

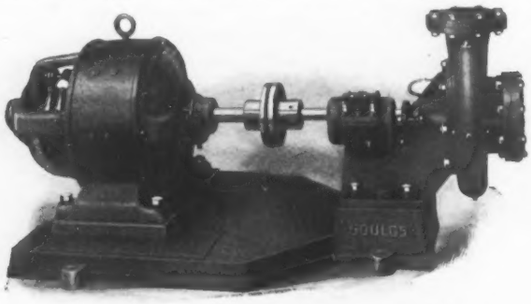


OUTDOOR SUBSTATION UNITS WITH HIGH RATINGS

the complete, mechanically interlocked switching, fusing and lightning-arrester apparatus for three-phase service shown herewith has been brought out. The lightning arrester used with this apparatus was described in the ELECTRICAL WORLD of Jan. 9 and is being made by Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, Ill. The apparatus shown is being placed on the market by the Delta-Star Electric Company, Chicago, Ill.

Motor-Driven Centrifugal Pump

A single-stage, single-suction inclosed-impeller-type centrifugal pump designed especially for direct connection to electric motors has just been placed on the



ELECTRICALLY OPERATED CENTRIFUGAL PUMP

market by the Goulds Manufacturing Company, Seneca Falls, N. Y. The casing is of the volute type, and is supported on the bed-plate in such a manner that it can be swiveled in any one of eight different positions. All main bearings are of the ring-oiling type. The end thrust of the impeller is taken by shaft collars bearing upon babbitted surfaces. These collars also serve to space the impeller properly in the casing. Both pump bearings are integral with the support head. The pumps and motor are mounted on one bed and are connected together by a flexible coupling.

Box for Concrete-Floor Construction

The use of concrete-floor construction has necessitated the use of two-piece outlet boxes to facilitate the installation of conduit and boxes. Six types of boxes, each with different depths for varying thicknesses of concrete, are being manu-

MALLEABLE-IRON OUTLET BOX FOR CONCRETE WORK

factured by the Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa. In installing the box it is fastened to the wood form with nails driven through the two outward projecting lugs. Conduits are attached with bushings and lock-nuts, and the cap or lid is then fastened on. If a fixture stem is to be used, it is attached before placing the cap on the box. The cap is lapped or flanged to prevent the cement from working into the box when the concrete is poured. The cap is provided with one 0.5-in. knock-out and four 0.25-in. clearance holes for the fixture stem. Boxes are provided with 0.5-in. and 0.75-in. knock-outs as required. All boxes are 4 in. in diameter and are sherardized.

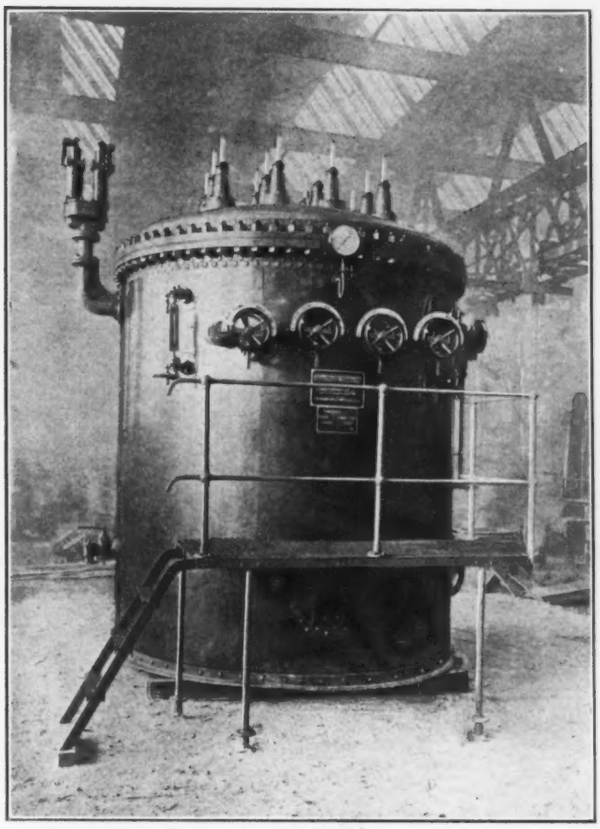
High-Voltage Alternating-Current Boilers

What is said to be one of the first large electric-boiler installations on this side of the Atlantic was recently made for the Wabasso Cotton Company, Ltd., Three Rivers, Quebec, Can. The plant consists of two 700-kva vertical boilers operating on three-phase alternating current at 2400 volts. The units are star-connected. The boilers are designed to generate steam at a pressure of 125 lb. per square inch, and tests have shown a thermal efficiency of 96 per cent on full load and of 92 per cent on half load. The shell and head of the boiler are thoroughly insulated, and as a result the steam pressure is kept fairly uniform.

In the accompanying illustration is shown a 2000-kw, 5000-volt boiler unit installed in Finland in Europe. The upper cover of this boiler is flanged, but in the Wabasso company's installation the covers are riveted to the shells. The inner equipment is conveyed inside through a manhole and consists of vertical porcelain

tubes of large diameter in each of which is a pair of electrodes. The upper and lower ends of these tubes are of different cross-sections. When the water is at its normal height the tubes are submerged.

The lower electrode is star-shaped and is fixed; the upper electrode is ring-shaped and is movable. Electrical energy is passed through the top of the tubes to the fixed electrode. The water entering the lower narrowed end of the porcelain tubes passes by the fixed electrode and becomes steam on its way to the upper electrode. The steam passes through this ring electrode and is taken through a steam outlet. The movable electrode is connected with and operated by a hand-wheel on the outside of the boiler shell, so that by raising or lowering this electrode the resistance can be increased or



2000-KW, 5000-VOLT ELECTRICALLY HEATED BOILER

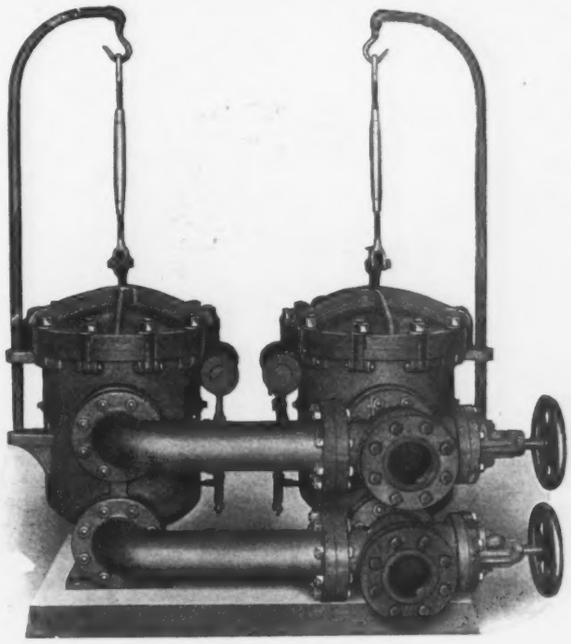
decreased. By arranging the electrodes in this way the boilers are made practically "fool-proof."

In a three-phase boiler three tubes are put into one group and a number of such groups form the total of all the tubes in the boiler. A 2400-kva boiler has, for instance, five groups or a total of fifteen tubes. Each group is equipped with its own switchboard apparatus. The boiler shell is always grounded. An installation of this kind is well adapted for use where a large surplus of hydraulically developed energy is available.

The installation of electric boilers described was made by Mr. E. Kaiser, Montreal, Quebec, Canada.

Feed-Water Filter

A feed-water filter and grease extractor with twin bodies controlled by a single set of inlet and outlet valves has recently been developed by James Beggs & Company, 38 Warren Street, New York. This device is designed particularly for service where the load is variable. When turning the valves to one limit only one side is operated, and by turning them to the other limit the other side is placed in operation. If the valves are turned to the middle position, both sides are operated. The valves are of the double-seat type and the disk working between the seats is self-seating, thus preventing leakage due to dirt deposited on either disk

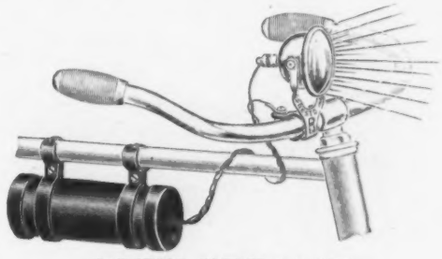


TWIN-BODY FEED-WATER FILTER

or seat. The filter chests are similar to those employed with the single-body type of filter made by the above company. Each chest is divided into an inlet and an outlet chamber by a partition carrying the filtering cartridges. Each cartridge consists of two concentric perforated-brass cylinders which are covered with linen terry cloth in such a manner that two uniformly separated and successive filtering surfaces are put into the path of all entering water. A large cover is provided for this Blackburn-Smith filter, as it is called, which is removed by means of a crane and turnbuckle as shown.

Electric Lamp for Bicycles

The "Presto" electric bicycle lamp shown in the accompanying illustration is designed to operate on one dry cell held in a black-enameled container clamped to the bicycle frame and connected to the tungsten lamp employed by means of weatherproof wires. A reflector and a 2-in. lens are employed for reflecting and directing the ray of light. At the back of the reflector a

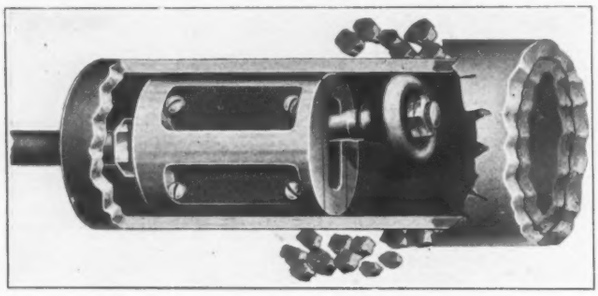


ELECTRIC BICYCLE LAMP

switch is provided for controlling the lamp. The lantern is mounted on pivots so as to permit the rider to adjust the lamp readily at any desired angle. These lamps are manufactured by the Metal Specialties Manufacturing Company, 736-738 West Monroe Street, Chicago, Ill.

Boiler-Tube Cleaner

A device called a scale knocker which is designed to knock off the scale from boiler tubes is being made by W. N. Matthews & Brother, St. Louis, Mo. The device consists of only five parts, and it has no valve. It may be operated by compressed air or steam, a pressure of

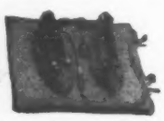


SCALE KNOCKER

only 25 lb. per sq. in. being necessary to drive it. The device is made in various sizes to clean tubes of the following diameters: 3 in., 3.5 in., 4 in., 4.5 in., 5 in. and 6 in. Attachments are provided so that one knocker can be utilized to clean tubes of different sizes, provided the difference in size be not too great.

Combination Heating Pad and Foot Warmer

An electric heating device, which can be used as either a heating pad or a foot warmer with slippers attached, is being offered for sale by the William E. Slaughter Company, 1714 Michigan Avenue, Chicago. The heating pad proper, which measures 13 in. by 15 in., is provided with two removable coverings. If the device is to be used as a hot-water bottle or for a like purpose, it is incased in a plain eiderdown cover. If, however, it is to be used as a foot warmer, it is inclosed in a cover to which comfortable bedroom slippers are attached.



Elevator-Door Switch

A safety elevator-door switch operating at 2 amp and 250 volts is shown in the accompanying illustration. The device is an inclosed single-pole spring-opened switch and is automatically closed by the elevator door. Use is made of a face contact so that it is impossible for the

DOOR SWITCH FOR ELEVATORS

switch to stick. The switch can be fastened to a latch or locking bar, compelling the operator not only to close the door but also to lock it. The switch has been developed by Franz A. Boedtcher, 413 West Forty-first Street, New York.

Detachable Insulators and Splicing Links for Pull-Socket Chains

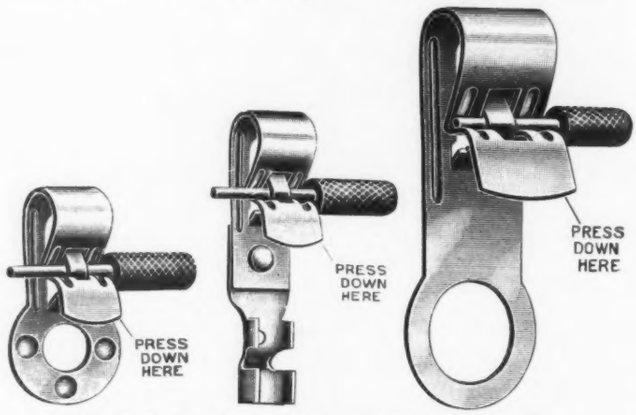
A new detachable insulator and a splicing link for pull-socket chains are shown in the accompanying illustrations. Both devices are made on the same principle

FIGS. 1 AND 2—SPLICING LINK AND DETACHABLE INSULATOR

and may be readily attached or detached. With the insulator or splicing link attached, the chain is said to hang perfectly straight. These devices are manufactured by the Arrow Electric Company, Hartford, Conn.

Spring Binding Posts

In the accompanying illustrations are shown several types of spring binding posts or connectors recently developed by the Fahnestock Electric Company, 129



FIGS. 1, 2 AND 3—BRONZE SPRING CONNECTORS

Patchen Avenue, Brooklyn, N. Y. A number of different kinds of spring connectors are being made by the Fahnestock Company and they are of spring brass when designed for indoor use or when not subjected to low temperatures. For outside work, such as telephone or telegraph lines, a special spring bronze is utilized, which

FIGS. 4 AND 5—LEFT-HAND AND RIGHT-HAND CONNECTORS

withstands the effects of cold weather better than the brass. If desired, the binding posts are finished in white nickel. The devices shown in Figs. 1, 2 and 3 are made only of bronze. The over-all length of the connector illustrated in Fig. 1 is 1 3/16 in. and the

width through the screw hole is 5/8 in.; the over-all length of that shown in Fig. 2 is 1 5/8 in. and the width is 3/8 in. The connector shown in Fig. 3 is 2 1/4 in. long and 7/8 in. wide, through the screw-hole. The two former are designed to take No. 10 B. & S. wire and the latter No. 6 B. & S. wire. In Figs. 4 and 5 are shown full-sized views of a left-hand connector and a right-hand connector designed for No. 10 B. & S. wire. The length of each is 1 3/16 in. and the width through screw-hole is 1 in.

Hickey Fixture Hangers

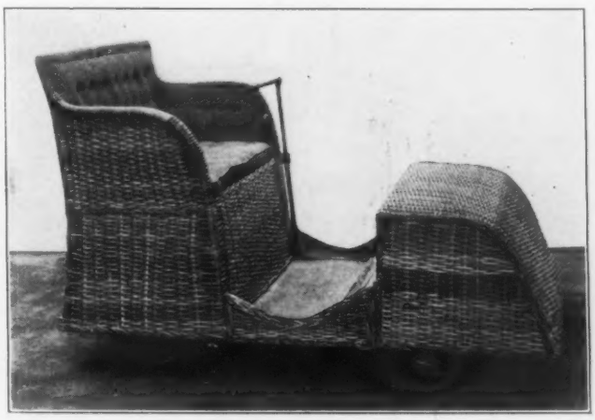
The hickey fixture hanger shown in the accompanying illustration is designed to be attached to the conduit inside the ceiling outlet box, and the rounded opening

HICKEY FIXTURE HANGER

serves the purpose of a bushing. The insulating joint or coupling is screwed on the male end of the hanger. The hangers are made of ductile malleable iron, sherardized to prevent rust. They are manufactured by the Steel City Electric Company, 1207-1219 Columbus Avenue, Pittsburgh, Pa.

Electric Wheel Chair

The two-passenger electric vehicle shown herewith has been designed particularly for use at the California expositions in San Diego and San Francisco. Use is made of a rattan body which is only 8 in. above the ground floor. The seat is 18 in. high, 20 in. deep and 38 in. wide. The vehicle operates at a speed of three miles per hour and will run for eight hours on one charge. An inclosed automobile motor is used to operate the vehicle, and it is equipped with ball bearings and aluminum end pieces. Double reduction is provided by back gearing, using a rawhide pinion and a



ELECTRICALLY OPERATED WHEEL CHAIR

cast-iron gear. Final drive is obtained by means of a chain connected to the rear wheel. Steering is accomplished by means of a horizontal transverse lever across the driver's lap. The steering operation is performed by the right hand, and the lever can be folded up out of the way when not in use. Control is accomplished by the left hand, and two speeds can be obtained. An emergency stopping device is also provided. When use is made of this device the vehicle cannot be moved until the control lever is brought back to the neutral position. The rear wheels are 14 in. in diameter and the front wheels 8 in. in diameter. The total wheelbase is 45 in. The vehicle is being made by the Electriquette Manufacturing Company, Los Angeles, Cal.

Starting and Operating Characteristics of Single-Phase Motors

Century single-phase motors employ the operating principles of two distinct types of motors for starting and for normal operation respectively. In the case of the 1750-r.p.m. sixty-cycle motor, until a speed of ap-

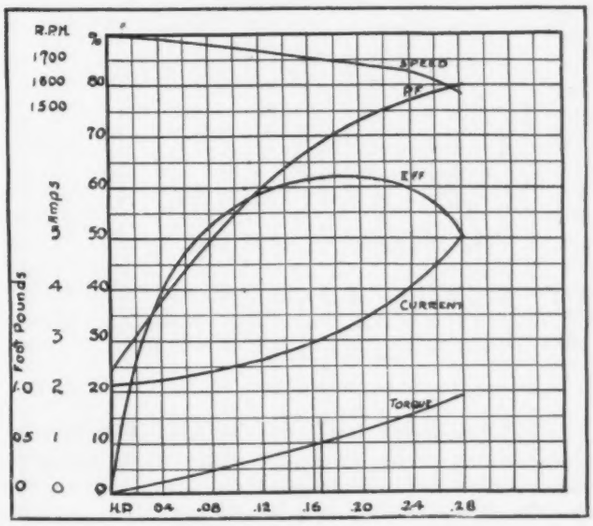


FIG. 1—PERFORMANCE CURVES

proximately 1500 r.p.m. has been attained the motor operates as a repulsion motor, but at this speed a centrifugal governor lifts the brushes and short-circuits the commutator, thereby automatically converting the motor into an induction motor. This combines a series characteristic on starting with the induction characteristic at normal speeds. The series characteristic is shown by the values of the torques obtained during tests made on one of these motors by the engineers of a central-station organization:

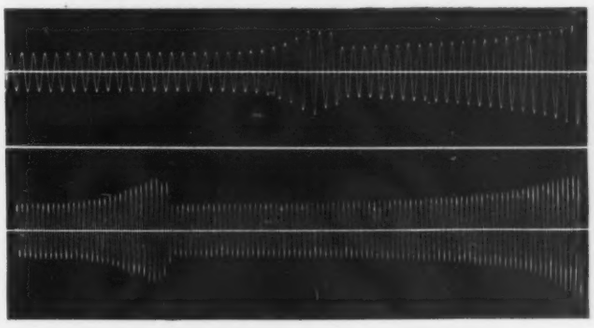


FIG. 2—OSCILLOGRAM DIAGRAM

Locked torque in percentage of full-load torque at normal voltage, 340; maximum starting torque in percentage of full-load torque at normal voltage, 150.

The complete performance of the motor on a brake load, with 103 volts at the motor terminals (the motor

is wound for 104 volts), is shown in the attached curves. It will be noted that in these tests, observed by the central-station testing engineer, the motor showed an efficiency of 62 per cent and a power-factor of 69 per cent on 103 volts.

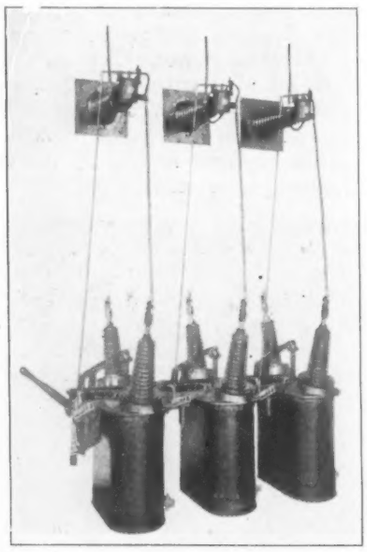
The starting torque is sufficiently high on 104 volts for the motor to start its full load so quickly that a 3-amp fuse will remain in circuit. The starting currents with the motor unloaded and fully loaded are shown in the oscillograms herewith. The time of starting with no load is 0.6 second and with full load is 2 seconds. Instantaneous flow of current is 8.2 amp in both instances, and the average current during starting period is 5.2 amp and 3.7 amp respectively. The average starting current under no load is higher, owing to the shorter time required by the motor to accelerate to full speed.

The maximum temperature rises at rated voltage and load as measured by the thermometer were as follows: Armature, 29 deg. C.; field, 32 deg. C.; bearings, 21 deg. C.

According to the Century Electric Company, St. Louis, Mo., manufacturer of the motors, use of one of these machines has been especially advocated by central-station operators for driving apparatus which requires frequent starting, especially during lighting hours, since the starting of these motors does not produce a noticeable fluctuation in lamps fed from the same cut-out. The motors are also advocated for the operation of apparatus requiring a heavy starting torque, and for applications where the motor is installed in a cold place, since in the ring-oiling bearings oil may be used which remains fluid at low temperatures.

Series Trip for High-Voltage Oil Switches

Low-voltage energy is usually employed to trip high-voltage automatic oil switches on the occurrence of abnormal conditions against which the automatic features are intended to guard. Electrically operated switches are usually tripped by means of direct-current energy, and for tripping hand-operated switches alternating-current energy is generally used. In many cases,



45,000-VOLT OIL SWITCH WITH TRIPLE-POLE TIME-LIMIT SERIES TRIP

however, neither low-voltage direct-current energy nor alternating-current energy is conveniently or cheaply available, and then automatic protection is secured by the aid of a high-voltage series trip. For this service the General Electric Company, Schenectady, N. Y., has developed the arrangement illustrated herewith, the features of which, it is claimed, are accessibility of the working parts for inspection, absence of danger when cleaning or adjusting while in service and calibration at the oil switch itself and not at the insulator supporting the series tripping solenoid. Use is made of a new type of solenoid which, the manufacturers assert, consists of a few simple and rugged parts that require little attention after installation. The solenoid plunger is connected to the tripping mechanism of the oil switch by a wooden rod. Calibration is accomplished by a movable weight near the operating mechanism of the switch at a considerable distance from the high-voltage circuit. The series trip is designed for instantaneous or inverse-time-limit operation. Delay is obtained by means of a dashpot mounted on the tripping mechanism at the switch.

Protective Stopper-Spinning Machine

The accompanying illustrations show a recently developed protective stopper for bottles and the type of

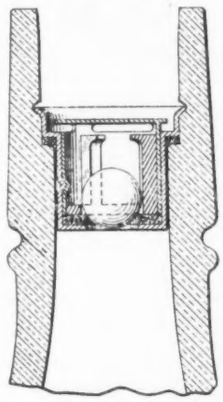


FIG. 1—PROTECTIVE STOPPER

machine employed for spinning the stoppers into the necks of bottles. The stopper consists of a copper cage which is heavily silver-plated and which carries a plated

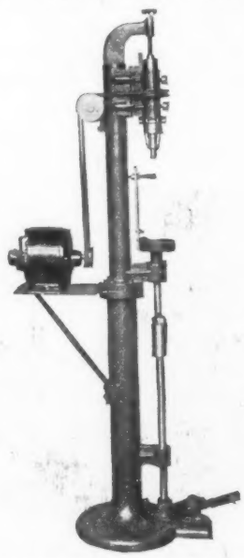


FIG. 2—STOPPER-SPINNING MACHINE

ball about ⅜ in. in diameter. These stoppers are spun into the bottles after they have been filled. The filled bottle is placed on the stand of the machine shown in the accompanying illustration and the platform is raised

to meet the spindle which spins the stopper into the groove in the neck of the bottle. The machines are designed to be driven by ¼-hp or 1/6-hp direct-current or alternating-current motors operating on 110 volts or 220 volts. The height of the machine is 72 in. and the floor space required is 15 in. by 32 in. After a stopper is spun in place it is practically impossible to refill the bottle without destroying it. The contents of a bottle can easily be removed by a steady pour, and the operation of the stopper is not affected by any climatic conditions. The machine is capable of spinning about thirty to forty stoppers per minute. The motor is manufactured by the Robbins & Myers Company, Springfield, Ohio, and the spinning machine and stoppers by the Simplex Protective Stopper Company, Baltimore, Md.

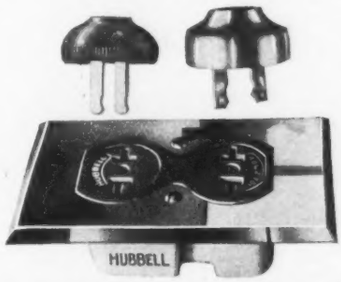
Portable Electric Heater

While not designed to replace the usual household heating appliances, an electric heater being marketed by the Despatch Manufacturing Company, of Minneapolis, Minn., is said to be particularly well adapted for use in bathrooms, nurseries and sick-rooms. In short, it is a light-weight electric heater built especially for use in place of the well-known type of oil stove and gas stove, which it so closely resembles. The standard rating of this heater is 660 watts at 110 volts, but special orders have been taken by the manufacturer to produce heaters of this type with 800-watt heating elements for 220-volt service.

SMALL ELECTRIC HEATER FOR BATHROOMS, NURSERIES, ETC.

Duplex Flush Receptacle

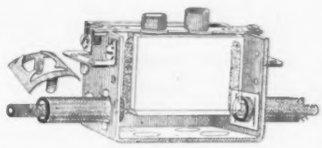
The flush receptacle shown herewith is provided with two outlets and is designed to take a single-gang outlet box. The contact openings are made in the shape of a "T" slot which will permit the use of a knife-blade cap made by Harvey Hubbell, Inc., Bridgeport, Conn., the manufacturer of the device. Smaller types of caps with blades set in the opposite direction can also be utilized with this receptacle. The energy-carrying terminals are deeply inserted to eliminate the danger of short-circuits. The duplex flush receptacle will take any one of an assortment of seventeen different types of caps made by the above manufacturer. Only one set of binding screws for wiring is utilized. The base is of porcelain and is extra heavy, as are also the lugs supporting the receptacle to the outlet box.



FLUSH RECEPTACLE WITH TWO OUTLETS

Clip for Loom-Wiring

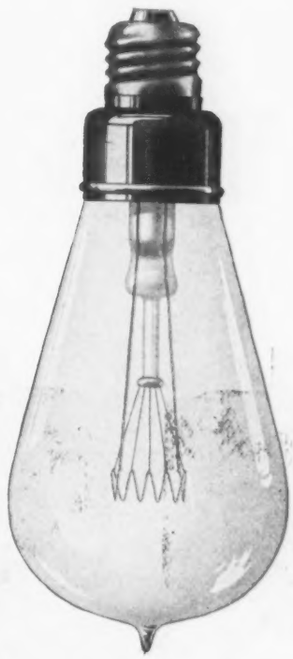
A clip designed for use with loom-wiring in switch boxes is being made by the Christo Manufacturing Company, Richmond, Va. The device is of galvanized steel and is made in two sizes. It can be used with conductors for ⅝-in. and ⅞-in. knock-outs. The clip consists of one piece and is designed to grip the loom when adjusted. After the clip is installed it is flattened out with pliers, and two small lugs which pass through the knock-out are bent over on the outside of the box, thus securely fastening the loom.



CLIP FOR CIRCULAR LOOM

High-Efficiency 100-Watt Tungsten Lamp

The improvements in lamp manufacture which have in the past year and a half resulted in the commercial development of high-efficiency incandescent lamps with ratings of 1500 cp or over have also been gradually extended to lamps of small ratings. Recently the National Lamp Works of the General Electric Company, Cleve-

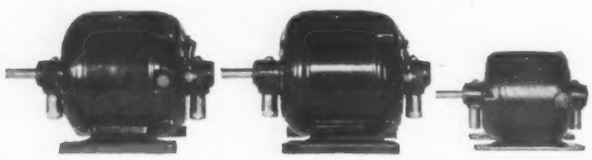


100-WATT HIGH-EFFICIENCY LAMP

land, Ohio, developed a 100-watt lamp which is similar in general appearance to the larger nitrogen-filled units and which embodies the helically coiled filament and a mounting similar to that employed with the larger units. The bulb is 3 1/16 in. in diameter, being 11/16 in. less than that of the old 100-watt lamps. The lamp is so designed that the center length has not been changed, and the sockets and reflectors employed with the old lamps can be utilized with the new unit. The lamp takes 0.8 watt per cp, giving a total of 125 cp. Because of the high temperature at which the lamp is operated, the color quality of the light, it is declared, approaches closely that of the high-efficiency lamps now on the market. On account of the method of supporting the filament the new lamp must be burned with tip downward.

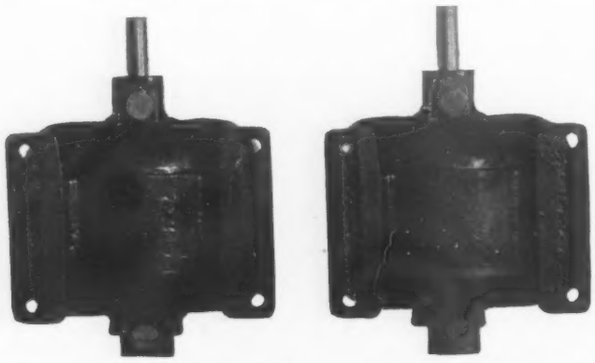
Fractional Horse-Power Motors

Small motors rated at from 1/50 hp to ¼ hp and designed for use on direct-current and alternating-current circuits have just been placed on the market by the Diehl Manufacturing Company, Elizabeth, N. J. The



FIGS. 1, 2 AND 3—1/25-HP DIRECT-CURRENT MOTOR, 1/25-HP ALTERNATING-CURRENT MOTOR, AND 1/50-HP MOTOR

frames for the alternating-current and direct-current machines of similar ratings are interchangeable. Mechanically, the manufacturers declare, the motors are made as light in weight and as strong as possible, and ample ventilating space is provided, although all moving parts are protected with a view to internal cleanliness. The feet of the motors do not project beyond the body lines and are drilled for attachment purposes. Channels are provided in the bearings so that the excess oil can be returned to the cups. Curves plotted from the performance of a direct-current motor and an alternating-current motor of similar rating show characteristics, the manufacturers claim, from no load to full load which are practically identical. The 1/50-hp and 1/25-hp motors are equipped with die-cast shells and covers. The larger machines are equipped with

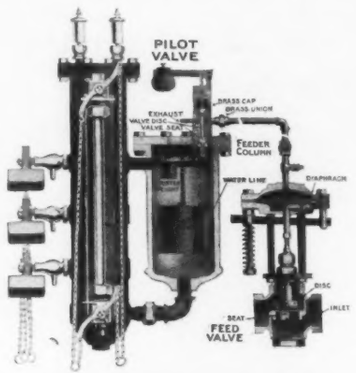


FIGS. 4 AND 5—DIRECT-CURRENT AND ALTERNATING-CURRENT ⅛-HP MOTORS INVERTED

cast-iron frames and covers. The motors will develop a starting torque, it is claimed, equivalent to not less than 150 per cent of full-load running torque. Figs. 1 and 2 show two 1/25-hp motors with identical frames, although one machine is designed for alternating-current service and the other for direct-current service. Figs. 4 and 5 show a ⅛-hp direct-current motor and a ⅛-hp alternating-current motor in inverted positions. The spacing and boring of feet of the alternating-current motor and the direct-current motor are shown to be the same.

Pilot Valve for Feed-Water Regulator

The pilot valve on the automatic feed-water regulator shown herewith, the maker of which is the Kitts Manufacturing Company, Oswego, N. Y., is a recently developed device. When the water in the boiler reaches its normal level the pilot valve automatically opens, admits steam to the diaphragm of the feed valve and closes it. As soon as the level of the water drops 0.25



AUTOMATIC FEED-WATER REGULATOR

in. the pilot valve closes and instantly releases the steam from the diaphragm of the feed valve. The latter valve is opened by pressure from the pumping system. As soon as the water rises to its normal level, the former operation is repeated. The pilot valve can be removed from the cover for repairs while the boiler is under pressure. The feed valve is equipped with removable seat and disk and is of brass or iron screwed and flanged body.

Signal-Lamp Attachment Plug

An attachment plug designed for use with signal lamps is being made by Harvey Hubbell, Inc., Bridgeport, Conn. The device is shown herewith connected to a 115-volt candelabra-base lamp which is protected by a tin-plated lamp guard. The device is designed for use with electrically heated devices of 10-amp rating or less. The plugs are equipped with knife-blade con-

SIGNAL LAMP AND ATTACHMENT PLUG

tacts and are interchangeable with various types of attachment plugs for wall and flush receptacles of corresponding rating and style made by the above manufacturers. The base of the device is of a heat-proof composition.

Low-Voltage Battery-Charging Device

A rectifier of the vibrating type has been developed by the St. Louis Electrical Works, 5407 Easton Avenue, St. Louis, Mo. A transformer is employed to step the potential, usually 110 volts, down to the desired amount to charge the battery, and to one end of the low-voltage

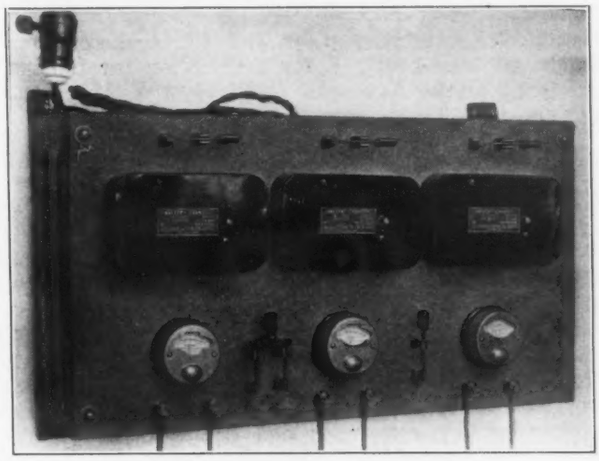


FIG. 1—RECTIFIER WITH THREE VIBRATING MOVEMENTS

winding is connected an armature of a polarized relay, whose electromagnets are energized by the transformer. At the end of the armature is a platinum contact which touches a stationary contact to which one lead of the battery is connected. The other end of the low-voltage winding is connected to a resistor, which in turn is connected to the other battery lead. A permanent magnet of tungsten steel is placed so that its leakage flux produces poles in the armature. This flux combined with that from the electromagnet causes the armature to vibrate at the same frequency as that of the alternating-current supply. The movable and stationary contacts are so related that they allow energy to flow through the battery-charging circuit in only one direction. Practically no sparking will occur at the contacts as they open only when the instantaneous current is zero.

The apparatus illustrated in Fig. 1 consists of a

FIG. 2—RECTIFIER WITH ONE VIBRATING MOVEMENT

transformer with three secondary windings which are connected to three rectifying devices mounted on a slate panel. The panel is 22 in. by 14 in. and is mounted on an iron frame which can be attached to the wall. The transformer is mounted on the rear of the panel and is inclosed by the iron frame. The three rectifying devices are mounted on the front of the panel as shown. Other apparatus is being made with one recti-

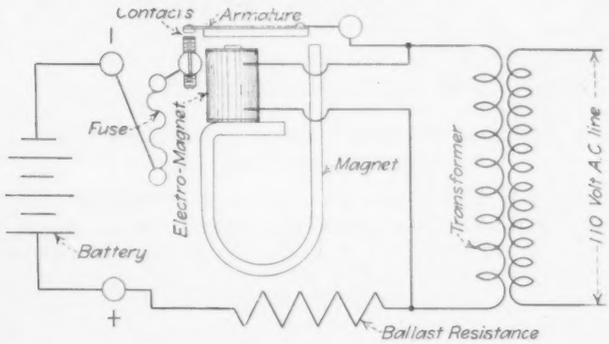


FIG. 3—DIAGRAM OF CONNECTIONS

fying device (Fig. 2) and also with two rectifying devices. Fig. 3 shows a diagram of connections.

Pendent Fixture for Street-Lighting Service

Outdoor fixtures designed for use with nitrogen-filled lamps are being made by the Adams-Bagnall Electric Company, Cleveland, Ohio. In the accompanying illustration is shown a pendent unit, which is equipped with a compensator for changing the current from 6.6 amp or 7.5 amp to 15 amp or 20 amp as desired. The case is of stamped copper or steel and is supported by a stamped-copper or steel top. The top, with the compensator and the lamp sockets, is suspended from a cast-iron insulated hanger. The case and globe may be removed, leaving the top and working parts of the lamp suspended. The case is attached to the top by a bayonet joint which is locked in position by a spring. The globe is also secured to the case by a bayonet joint. A chain is provided so that the globe can be suspended below the lamps while cleaning. Units of this type may be equipped with a pear-shaped diffusing globe or with a

"ARC-LAMP" FIXTURE FOR NITROGEN-FILLED LAMPS

globe and concentric-ring reflector. If a copper case is employed, it is finished in gun-metal, and if a steel case is used, it is finished in baked-enamel. Leads are brought out under the ventilating cap through porcelain terminals. The total weight of the unit is 25 lb.

CURRENT NEWS SECTION

Steps in Investigation of the United Gas Improvement Company

Reports from Washington are to the effect that President Bodine of the United Gas Improvement Company has been in consultation at the Department of Justice with Mr. George Carroll Todd, assistant to the Attorney-General, with reference to the suit that it has been reported the government intends to file against this company.

It is understood that Mr. Bodine has made an agreement with Mr. Todd that he shall be allowed to submit certain documents with reference to the contracts that his company has made with other companies, the legality and propriety of which certain complainants to the Department of Justice have questioned.

Irrespective of any difference of opinion which may exist between the Department of Justice and counsel for the United Gas Improvement Company, it is said at the department that there is a likelihood that these differences will be settled. The Washington correspondent of the ELECTRICAL WORLD reports that every effort is being made by the administration to be of service to business, so far as may be consistent with the laws, and it is said that if the United Gas Improvement Company can so arrange the details of its business concerning the Welsbach company and other companies as to which there may be differences of opinion, the government will not file a suit under the Sherman anti-trust act, such as has been suggested.

The most recent reports at the Department of Justice are that in case it is necessary a "consent decree" will be filed. Such a decree would naturally take the position that the business of the company has been in violation of the interstate commerce laws. It is believed that the consent of the Department of Justice to receive further representations as to the business of the United Gas Improvement Company carries with it the fact that complaints as to its being in violation of the law need to be fully supported.

"The Status of the Engineer"

The subject of "The Status of the Engineer" has been proposed for discussion for a number of years in the American Institute of Electrical Engineers, but for one reason or another the matter has not matured. There has been a general desire to concentrate the attention of the Institute upon this subject, which is of much importance to its membership, largely composed of young men. Owing to a combination of circumstances, this is to take place at the winter convention of the Institute on the evening of Wednesday, Feb. 17.

The subject is to be introduced by Mr. L. B. Stillwell, who is to read a short introductory paper. He is to be followed by Mr. E. W. Rice, Jr., president of the General Electric Company; Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company; Mr. John Hays Hammond, past-president of the American Institute of Mining Engineers; Dr. George F. Swain, past-president of the American Society of Civil Engineers; Dr. Alexander C. Humphreys, president of the Stevens Institute of Technology and past-president of the American Society of Mechanical Engineers; Mr. H. G. Stott, past-president of the American Institute of Electrical Engineers, and Mr. J. J. Carty, the only candidate officially proposed for nomination for the next president of the American Institute of Electrical Engineers.

Sleet Damage Confined to Telegraph Lines in Wisconsin and Michigan

The sleet and snow storm which during the first days of last week swept the State of Wisconsin, southern Michigan, northern Illinois and parts of Iowa caused considerable damage to the lines of the telegraph and telephone companies, but, according to reports received from central-station managers in the districts worst hit, worked little or no injury to the outside wire plants of electric-lighting companies and transmission systems. Heavy sleet formed on all exposed wires in the territory visited by the storm, bringing the less sturdy spans to the ground. An unusual display of aurora borealis was also reported from the storm area.

While the wire damage sustained by the telegraph and telephone companies was very large, in many cases interrupting communication and isolating whole towns and cities during the worst of the blizzard, the number of poles carried down was relatively small in proportion to the number of wire breaks. The Bell telephone organization in Wisconsin reported, however, the loss of about 1500 poles, while the Western Union Telegraph Company lost 1200 poles. Repair crews were hurried out, and within four days normal operation had been restored. The Postal Telegraph Company brought line crews from New York and from Texas to repair the damage to its lines.

Slight Damage to Electric-Service Properties

The path of the storm appeared to lie across southern Wisconsin and southern Michigan. At Milwaukee the street-car system suffered perhaps worst. On Monday nineteen sweepers, nineteen snow plows and fifteen salt cars were kept in service. Soft snow re-froze over the rails and long icicles formed on the trolley wires. Green Bay, Wis., underwent a severe snowstorm, but slight injury resulted to the pole lines and distribution system. No damage was done to the overhead lines about Eau Claire, Wis. At Madison a steady rain turned into sleet which was accompanied by a 40-mile gale. Although the overhead structures of the local electric company were heavily coated with ice, no wires came down. The accumulation of ice on the ropes which support the street lamps made it, however, impossible to lower the lamps for trimming, and until the special gang of ten men could get to all the lamps to clean the ropes a few lamps were out of service. Madison was isolated from outside communication for twelve hours. At Janesville no damage worth mentioning was done to the lighting system. Operation of the transmission lines in the Platteville mining district was also without incident.

In the Michigan area affected by the storm a few transmission-line outages were reported. A break in the circuit near Kalamazoo left that city in darkness for a short time. On the system of the Peninsular Electric Light Company west of Detroit several sections of transmission line were carried down during the day, the accidents being due in almost every case to the breaking

of ground wires. In other instances interruption of telephone communication prevented proper switching. Heavy sleet formed and a high east wind continued all day Monday.

Commerce and the Federal Trade Commission

What is regarded in Washington as a most important development in connection with the new Federal Trade Commission is reported as the result of the convention of the Chamber of Commerce of the United States.

Gentlemen who have declined positions on the Federal Trade Commission upon the invitation of President Wilson have indicated in Washington their desire to serve upon the committee of the Chamber of Commerce of the United States which is to be appointed to serve in cooperation with the Federal Trade Commission.

It is understood that men of the highest caliber and connected with the most important relations of business to government will give their services on the committee.

The Washington correspondent of the ELECTRICAL WORLD reports that it is almost definitely settled that a gentleman connected with one of the electrical industries will be selected to serve upon the Chamber of Commerce committee. There may be two, but in any case it is said that Mr. Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, will be drafted for one of the positions.

Reports from Washington are to the effect that appointees to the commission will be closely scrutinized with reference to their views as to government ownership. It is said in Washington that, because of the underlying motives in connection with the ship purchase bill both for and against the principle of government ownership, that proposed measure is likely to play a part in regard to possible appointments to the Federal Trade Commission and any recommendations it may make hereafter.

It is understood that the name of Mr. William H. Parry, of Seattle, Wash., has been eliminated from the "slate" and that President Wilson will appoint a regular Republican instead of Mr. Parry, who is known as a Progressive. The name of Mr. William R. Wheeler, who was Assistant Secretary of Commerce and Labor during the Taft administration, is under consideration.

Republican Senators are also waging a fight against Mr. George L. Record, of New Jersey. He is a Progressive, and it is said that some of his views are too radical to suit Republican Senators.

Cedars Rapids-Massena Transmission Line in Service

On Jan. 4, 1915, service was inaugurated between Cedars Rapids, Quebec, and Massena, N. Y., over a 50-mile, 110,000-volt steel-tower transmission line erected by the Stone & Webster Construction Company, of Boston, Mass., for the Aluminum Company of America. The line is designed to transmit 60,000 hp and has a standard span on level ground of 660 ft., with a right-of-way 125 ft. wide. The towers are of three types. Suspension towers are designed for the maximum load of ice and wind and two conductors broken on one side; anchor towers, spaced one per mile, meet the same conditions but hold the conductors semi-rigidly by two sets of insulators, and dead-end towers, used only at angles and railroad crossings, are designed for all conductors broken on one side under the worst conditions of wind and ice. The towers support one seven-strand, ½-in. galvanized-steel ground cable and two 110,000-volt, sixty-cycle, three-phase circuits, each phase wire consisting of a 500,000-circ. mil aluminum cable with a 114,100-circ. mil steel core. The insulators are of the ten-disk suspension type, seven units being used on the top and bottom cross-arms of the suspension towers and eight units at all other attachments. Besides crossing the two channels of the St. Lawrence River, the line passes over the Soulanges and Cornwall canals, where the clearance of 155 ft. requires the use of 200-ft. towers. The standard towers support the conductors 40 ft. from the ground, with a minimum clearance of 24 ft. Double suspension insulators are used at the river crossings.

Los Angeles Seeks to Buy Distribution System

The City Council of Los Angeles, Cal., decided on Jan. 26 to ask the Southern California Edison Company to sell its distribution system to the city. The City Council met with the Board of Public Service Commissioners and received the recommendations of Mr. E. F. Scattergood, chief engineer of the electrical power bureau. It was stated that the distribution system of the Southern California Edison Company will be better for the purposes of the city than the system of any other of the three companies operating in the city limits.

According to the figures presented to the City Council, the system of the Southern California Edison Company now reaches over 80 per cent of the area of the city and the company does approximately 45 per cent of the electrical business in the city.

The plan upon which the City Council and the commission decided was to ask the Railroad Commission of California to make a valuation of the property of the Southern California Edison Company. If the company refuses to accept the proposition of the city, it is announced that condemnation proceedings will be started.

Chicago Regulations Relating to Use of Gas-Filled Lamps

The Department of Gas and Electricity of the city of Chicago has formulated the following regulations for the use of gas-filled incandescent lamps, the high operating temperature of which makes necessary special precautions in making installations. The enforcement of these rules followed a meeting Feb. 4 of persons interested in the manufacture, sale, installation and use of these lamps, at which the proposed rules were read and discussed by Mr. Victor H. Tousley, chief electrical inspector, and others present. According to Mr. Tousley, there have been practically no accidents from overheating of these lamps in Chicago, but it is feared that future trouble may result from the baking of the insulation on the wires leading to these lamps, in the high temperatures which they set up.

Circuits.—Must have a cut-out for each lamp, except that where the combined wattage of two or more lamps does not exceed 660 watts they may be dependent upon the same cutout. Special permission may be granted for circuits of 1320 watts capacity where wire equal in size and insulation to standard No. 14 B. & S. gage wire is carried directly into keyless sockets or receptacles and where the location of the sockets or receptacles is such as to render unlikely the attachment of flexible cords.

Wires.—Fixtures exposed to the weather must be wired with rubber-covered wire. Fixtures for inside use must be provided with a stem or its equivalent not less than 6 in. long and must be wired with asbestos or slow-burning wire. Fixtures so designed that operated with the largest lamp for which they are intended they do not attain a temperature in any part of the wiring of over 120 deg. Fahr. may be used without stems. Lamps complying with the temperature requirements given under

"fixtures" may be used in exposed conduit work or in trough reflectors wired with slow-burning wire.

Sockets or Receptacles.—Brass-shell, fiber-lined sockets must not be used for lamps above 200 watts or where inclosed by a shade, reflector or by any part of the fixtures. Sockets or receptacles with medium (standard) bases must not be used for lamps above 200 watts capacity.

Fixtures.—Must not be used in show windows or in other locations where inflammable material is liable to come in contact with the same unless the lamp is inclosed in an approved fixture where the temperature of any exposed portion of fixture or lamp does not exceed 200 deg. Fahr. Where the lamp comes within the usual range of vision, it must be provided with a suitable shade which will so reduce the intensity of the light that it will not be injurious to the eyes.

N. E. L. A. Convention Plans

On Feb. 8 Secretary T. C. Martin of the National Electric Light Association returned to New York after a trip to San Francisco for the purpose of going over the plans for the convention to be held in that city from June 7 to 11. In Chicago conferences were held with Mr. E. W. Lloyd concerning the Commercial Section convention, Mr. P. Junkersfeld in reference to the technical program, and Mr. H. E. Niesz in regard to Jovian co-operation.

In San Francisco a meeting of the general convention committee was held, and in addition Secretary Martin had a conference with the chairman of each sub-committee. At a joint meeting of the San Francisco Section of the American Institute of Electrical Engineers and the N. E. L. A. company section, at which Mr. Frank G. Baum read a paper on "The Best Control of Public Utilities," Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, and Mr. Martin spoke on the general convention plans. At a lunch of the Electrical Development League of San Francisco Mr. Martin invited co-operation.

In speaking to a representative of the ELECTRICAL WORLD, Mr. Martin said: "After very careful study of the ground and consideration of all the questions concerned, it appeared to be best to arrange to hold the meetings in the new building of the Native Sons of the Golden West. This is at 414 Mason Street, one-half block from the Hotel St. Francis and the Hotel Clift and within convenient distance of all of the leading hotels. The hall at the Civic Center, which was under consideration, is not situated as conveniently and does not have facilities that would accommodate our different meetings and provide for offices and conferences so satisfactorily as the building which was finally selected.

"Registration day will be on Monday, June 7. The annual reception of the president will be held in the evening at the Hotel St. Francis.

"Business sessions will be held morning and afternoon on Tuesday. Trips to Mount Tamalpais and the Muir Woods, with luncheon, will be arranged for the ladies. In the evening a visit will be made to the Exposition.

"On Wednesday morning there will be business sessions. This will be 'Electrical Day,' and in the afternoon a visit will be made to the Exposition. A musicale will be given for the ladies at the California Counties Building and tea will be served. At the public policy committee meeting in the evening the report of the committee will be presented and addresses will probably be made by a prominent resident of California and others.

"On Thursday the last business sessions will be held. In the evening there will be a Jovian rejuvenation and a vaudeville show by the Pacific Service N. E. L. A. section. An automobile trip to Crystal Springs Lake, with lunch, will be given for the ladies.

"Delegates who remain on Friday and Saturday will be entertained.

"In the new building which is the home of the Native Sons of the Golden West there will be ample room for all of our meetings. The auditorium on the first floor, which will accommodate from 1200 to 1400 people, will be used for general meetings. It will also be used for the public policy meeting and, with the gallery, which will be open for that purpose, will accommodate 1500 people. The social hall in the basement, which will be used for the meetings of the Commercial Section, will accommodate about 750 people. On the fourth floor is the meeting room for the sessions of the Accounting Section. Rooms will also be prepared on this floor for the entertainment committee, transportation committee, the *Daily*, local registration and the official stenographers.

"Already sixteen hotels are on our list and we have reserved 800 rooms. After a certain date we shall have to release any of these rooms that have not been taken or we shall be penalized for holding them further. The hotels are adhering to their schedules, which will be moderate, but are stipulating that after the Exposition opens they shall have the privilege of 'doubling up' on single rooms. The effect of this stipulation is that any one who takes a single room and wants to be sure of being alone will have to pay double rate."

Leaving for Los Angeles on Jan. 23, Mr. Martin remained in that city until Jan. 26, meeting the officials of member companies and attending a lunch at the local Electrical Development League. He went from Los Angeles to Salt Lake City, where he was entertained by Mr. C. E. Groesbeck and officials of the Utah Power & Light Company. On Jan. 28 he delivered an address at a meeting of the local company section and four other engineering bodies, and the N. E. L. A. Halloran lecture on electrical features of the Exposition was delivered before about 400 people.

From Salt Lake City Mr. Martin went to Denver, where he was entertained at dinner on Jan. 30 by the Colorado Electric Club and the company local section. On Feb. 1, at Kansas City, he was entertained by Chairman E. J. Bowers and other officials of the company section and President J. M. Egan of the Kansas City Electric Light Company. On Feb. 2, at St. Louis, Mr. A. C. Einstein, member of the executive committee, and Mr. Martin addressed the Jovian Order at lunch. The afternoon was spent with the executive committee of the local company section.

Mr. Martin was in Cincinnati on Feb. 3 and discussed with Mr. W. W. Freeman, chairman of the public policy Committee, the work of that committee. Leaving in the afternon of that day for Dayton, he assisted in the inauguration of a new company section, which has been started with a membership of more than fifty. On Feb. 4, returning to Cincinnati, he took part in the inauguration of the new company section of the Union Gas & Electric Company, which has 150 members. During his stay in Ohio Secretary Martin also assisted in making plans for new company sections in Cleveland, Youngstown and Columbus.

"I found general conditions spotty, with several areas of depression, but on the whole an increasing note of hopefulness and confidence," said Mr. Martin. "It is a period of caution and restriction as to operating expenses and new expenditures, but every central-station manager I met realizes that the maintenance of efficient public service demands, and depends upon, continuous expenditures, because even through the dullest of bad times each community tends to grow and its electric

service must be provided for. One of the curious features which manifested themselves is the fact that while in the East all the large companies are intensely interested in problems connected with the wiring of existing buildings, in the Far West this is regarded as a closed incident, as 95 per cent or 100 per cent of the existing buildings are already wired. Western people wonder what their friends in the East are talking about. There was, however, a great deal of interest in the West in the new question of concentric bare wiring which, if properly installed after thorough testing, it was thought might greatly simplify and cheapen work in many new buildings hereafter.

"Throughout the trip the greatest interest was manifested in the convention as well as in the wonderful San Francisco Exposition, the lighting effects of which are the finest I have ever seen. It is beyond question assured that the attendance will at least reach estimates and will far exceed the point reached at Seattle in 1912."

Nearly 1000 cards have already been received at the association headquarters asking for itineraries of the special tours. Circular letters are being sent to every central-station and manufacturing company member. The Jovian Order is also issuing a notice in regard to the convention to all its members.

New York Telephone Rate Case

At a hearing before a committee of the New York Legislature which is investigating the telephone situation in New York City Prof. Edward W. Bemis, of Chicago, testified that reductions in rates should be made.

Professor Bemis, basing his opinion on the petition of the Court of Appeals in the Kings County Lighting Company case, said that it was impossible for any company which had been profitable from its inception to add anything to its capital account for going value. Taking the property of the New York Telephone Company at $65,000,000 and allowing it a return of 7 per cent, it would be possible, he said, to make concessions to the public of the value of $5,675,000 a year. He said that low rates would stimulate business. Professor Bemis also attacked the arrangement by which the New York Telephone Company pays the American Telephone & Telegraph Company as a rental for its telephone transmitters, receivers and induction coils 4½ per cent of its gross receipts.

Central-Station Rate Bill Opposed at Boston

The Massachusetts legislative committee on public lighting gave a final hearing on Feb. 8 upon the bill of the New England Power League limiting the price of electrical energy marketed by central stations to from 5 to 25 per cent above the cost of production and distribution. Representatives of various labor organizations and isolated-plant engineers cited instances of differential rates in Boston, Worcester and elsewhere and urged that the maximum price be reduced by legislative action. Mr. Everett W. Burdett, general counsel of the National Electric Light Association, pointed out that passage of the bill would imperil the return on about $50,000,000 of central-station capital in Massachusetts alone and presented an exhaustive discussion of differential rates and the theory of their making. Mr. Burdett said that the real springs of the agitation represented by the bill are the dissatisfaction of Boston labor interests with the refusal of the Edison Electric Illuminating Company of Boston to formulate the recent street-lighting contract on lines sought by organized labor and the natural desire of steam engineers in isolated plants to avoid being thrown out of work temporarily by the introduction of central-station service.

Mr. Burdett said that the long-hour user gets the benefit of the lowest prices because he makes the most economical use of the plant at his disposal. Investment charges are much greater than the cost of production and distribution, and the central station turns over its capital only once in five years, compared with a turnover about twenty-five times as frequent in a mercantile business. Fixed charges may run as high as seven or ten times manufacturing and delivery costs in electric service, owing to the cost of readiness to serve. Contrary to the popular impression, the large consumer is the most profitable customer of the central station, and the revenue derived from him makes it possible to supply the small consumer at a rate much below what would be feasible if it were not for the large user of energy. The importance of time and duration of energy consumption as factors in rate-making were outlined, and in conclusion the speaker pointed out that the existence of competition has always been held by the courts as a justification of differential rates, provided service is not furnished at less than cost. The only means of reducing the price to the small consumer is by the greater use of the company's investment. The passage of the bill would result in a raising of prices or a diminution of service to all large users, which would be a disaster to small consumers. Mr. Burdett said that a valuation of central-station properties is unnecessary in Massachusetts, where the Gas and Electric Light Commission knows in great detail the money invested by each company and securities are issued at prices fixed by directors and approved or disapproved by the commission.

Mr. W. Rodman Peabody, for the Turners Falls Power Company, pointed out the importance of fixed charges in determining rates for hydroelectric energy and urged that the bill would make fair prices for such service impossible. Rates in force in power contracts depend upon local factors on such systems. Mr. Peabody said that a manufacturer purchasing energy near the generating plant at Turners Falls would object strenuously to being charged for service on the basis of including costs due to the Turners Falls-Springfield steel-tower line, and a cotton mill and an electric railway served by the company, with radical differences in the uniformity of their demands, could not with equity have the same rates quoted to them. Similarly, the steam-plant owner down the river who buys secondary power is in a class by himself. Rate-making on the basis of the bill would result in confusion and distress.

President W. H. Lang of the Massachusetts Association of Municipal Lighting Plants also opposed the bill on the ground that it attempts to maintain the paradox of high wages for the operating engineer combined with reduced costs to the consumer. He predicted that in a few years all the electrical energy distributed in the State would be generated in three or four plants of great size and maximum economy, forecasting the time when the smaller and less efficient stations would "go into the discard." The hearing was closed.

Holds That Cleveland Accounts Should Be Open

Through a decision of the Appellate Court, the suit of Mr. J. N. Patton, as a taxpayer, who seeks access to the accounts of the municipal light plant of Cleveland, Ohio, has been reinstated. On account of the action of the Common Pleas Court, which allowed the city to make the defense that Mr. Patton was not acting in good faith, but in the interest of private power and light corporations, he lost his case in that court. The

higher court, however, sustained his demurrer. In announcing the decision Judge Grant said:

"The corporation, private or municipal, that cannot stand the light of day sooner or later must go to the wall. And if the managers of a municipal industry begin by withholding its affairs from the knowledge of its citizens, the latter will become justly suspicious."

Judge Grant said that the city in going into business is in a sense leading a dual life. It meets a competitor in its own citizens who are an integral part of itself, and they, finding the city waging a business warfare against them, have to meet the city in competition for the business they secure.

Judge Grant declared that the danger of inspection from improper motives, as alleged in the city's defense, is not to be compared with the danger that would follow the people's lack of confidence in their business servants. They never will have confidence in the city management if it apes the worst features of the old corporation idea, as exemplified in many of the New Jersey charters of a few years ago, he said.

The decision holds that Mr. Patton is before the court, not as a competitor of the city, but as one of its citizens and taxpayers and as such is a stockholder in the enterprise in question.

Ohio Court of Appeals Upholds Cincinnati Injunction

The Court of Appeals at Cincinnati, Ohio, on Feb. 5 reversed the decision of the Common Pleas Court, wherein the city and the Union Gas & Electric Company were refused an injunction to prevent the Diamond Light Company from laying wires and building conduits across the streets and alleys without a franchise from the City Council. In his decision Judge Gorman, of the Common Pleas Court, said that owners of abutting property on opposite sides of the street control the street and have a right to agree among themselves to grant permission for laying wires and conduits, so long as the street is not damaged as a thoroughfare, and that a franchise from the Council is not necessary. He also held that it was never intended that any corporation should have a monopoly of a business and that the estoppel of the Diamond Light Company would prevent it from entering into competition with the Union Gas & Electric Company.

Speaking of the rights of owners of abutting property, the Court of Appeals says that it is not necessary to consider them in this case, since the property owners were not made parties to the suit. However, there is no law to substitute their consent for that of the city, whatever their rights may be on their own behalf. The evidence as to the permission granted does not in any way pretend that it operates as a grant or conveyance of property rights in the streets and alleys.

The question as to whether the consent of the city should be given to the defendant is a matter of legislative policy, the court said, and must be determined by the Council and the city officials. It is not a judicial question for the determination of the court. If the action of the Council in refusing to grant permission to lay wires and conduits in the streets and alleys results in general dissatisfaction to the citizens and property owners of the community, the matter can be rectified by a change in the personnel of the Council and public officials. Where a legislative body has exercised its power in a manner that might be considered unwise or against the interest of the city or its citizens, the court has no right to intervene and substitute its views for those of the municipal authorities. The determination of whether or not consent should be given is vested in the Council itself.

The Council has refused such consent, and, whether wise or unwise, it is not a question for decision by the court, as no fraud or improper methods of arriving at this determination were shown. As the law provides that no such wires or conduits shall be laid or constructed without consent of the Council, said the court, the injunction sought must be allowed. The three judges of the court concurred in the decision.

Judge Gorman, who decided the case in Common Pleas Court, is about to succeed Judge Peter F. Swing on the Court of Appeals.

Museum of Safety Medal Awards

At the annual exercises of the American Museum of Safety, held in New York on Feb. 10, the following medals were awarded: The *Scientific American* medal for the most efficient safety device invented within a certain number of years and exhibited at the museum, to the Shurloc Elevator Safety Company, Inc., New York; the Travelers' Insurance Company's medal for protecting the lives and limbs of workmen, to the Commonwealth Edison Company of Chicago; the Louis Livingston Seaman medal for progress and achievement in the promotion of hygiene and the mitigation of occupational disease, to Surgeon-General William C. Gorgas, U. S. A.; the E. H. Harriman memorial medal to the American steam railroad which during the year has been the most successful in protecting the lives and health of its employees and of the public, to the New York Central Railroad; the Anthony N. Brady memorial medal to that American electric railway company which for the year of the award shall have done most to conserve the safety and health of the public and of its employees, to the Boston Elevated Railway Company. The jury of award gave honorable mention to the Public Service Railway Company of New Jersey and the Northern Ohio Traction & Light Company. Mr. Arthur Williams is president and Dr. William H. Tolman director of the American Museum of Safety.

Terms of Detroit Rate Agreement

Details of the new agreement regarding rates in Detroit are available. The Detroit Edison Company, through its operating companies, the Edison Illuminating Company and the Peninsular Electric Light Company, has had informal agreements as to rates for the last twelve years with the Common Council of Detroit. There are no franchise or ordinance rates and the City Council has no right to regulate, that power resting, according to the law, with the Michigan Railroad Commission, which can take action upon complaint. These informal agreements are, in fact, merely understandings put on record, after friendly discussion by letter and Council resolution, and running for successive periods of approximately three years.

A new agreement of this class has just been arrived at under which the maximum rate for commercial lighting is reduced from 12 cents per kw-hr. to 10 cents, subject to usual discounts for prompt payment. The follow-on rate of 4 cents, less discount, has not been changed, and the residence rate, which has a maximum of 14 cents followed by 4 cents, also remains unchanged.

All of the differential rates of the Detroit companies are characterized by rather high initial rate and low follow-on rate, and 90 per cent of their business is done on such rates. The result seems to be satisfactory to the local public, which is presumably explained by the

fact that the average residential service rate to some 73,000 customers in that class was 5.87 cents per kw-hr. in 914 and the average rate for commercial lighting on the ordinary one-year contract was 4.91 cents per kw-hr. The latter rate will be affected by the reduction.

In connection with this reduction the companies announce a change in their lamp policy. Heretofore they have, like many of the Edison companies, furnished a free installation and free renewal of carbon-filament lamps. In commercial service these carbon lamps to a very great extent have been replaced by tungsten-filament lamps owned by the customers. The companies have furnished renewals of tungsten-filament lamps at an excess charge, reduced from time to time but always much below the list price. Under the new plan the companies will cease to furnish any part of the original installation and will sell tungsten lamps for the original installation to the customer at the wholesale price plus a margin for handling and breakage. They will furnish renewals of 40-watt tungsten lamps free and of 60-watt and 100-watt tungsten lamps at 15 cents per lamp, promising to reduce the price of renewals of the 60-watt and 100-watt sizes from time to time until these also are free. The 25-watt lamp and the 150-watt and 250-watt lamps will be subject to a renewal charge of 25 cents per lamp.

This change of lamp policy will apply also to residential customers. But, in order to expedite the change-over from carbon-filament lamps to tungsten lamps, the companies intend to furnish ten to twenty tungsten lamps free to each residence customer now connected and to each new residence customer hereafter connected. This preference shown to residence customers is intended, according to the companies' statement to the Council, to take care of the small residential customer on whom the burden of buying a tungsten-lamp equipment would be serious.

This agreement is to run three years from midsummer of this year.

Messages of Governors on Public Utilities

In messages to the legislatures now beginning their sessions many governors of states refer to public utility affairs. In the two last issues we published extracts from these messages, and appended herewith are others dealing with the same topic.

Governor Ralston of Indiana

"I hesitated long before I espoused legislation creating a Public Service Commission. Such legislation runs counter to what had long been the policy in this country in dealing with the private affairs of individuals and corporations, and it goes a long way in setting aside the power of the people to control their own local affairs; but the people were demanding it and I stood with the Legislature for it. Now that we have the law there is but one thing that can be consistently done, and that is to give it a fair trial.

"There are those who assume an unfriendly attitude toward this commission on the ground that it is costing the State too much. The truth is there are several instances in which the commission has saved the people in a single case more than its annual cost.

"This commission has made mistakes of course. In the future it will make other mistakes. Its working force is not yet completely organized. In truth, it requires skill, patience and time to make up a competent and frictionless organization of expert engineers, accountants and assistants to carry on the work required by law of the commission; and it takes time for the commissioners themselves to get into the swing of their work, no matter what their ability is.

"I have expected great things of this commission and I have not been disappointed, no matter what the disappointments of others may have been. Disappointments sometimes come, perhaps unconsciously and unavoidably, out of existing conditions as compared with results hoped for; but as a rule the person who approaches a proposition with an unfriendly mind is most easily disappointed. Such an individual should not be followed in his errors by those who are normal and fair-minded."

Governor Walsh of Massachusetts

"I must repeat, with added emphasis, if possible, my last year's protest against the law which relieved the transportation and telephone and telegraph companies—already favored by the exemption of much of their physical property from local taxation—from defraying the cost of the Public Service Commission, thereby adding nearly $200,000 annually to the State tax. As I pointed out last year, it matters absolutely nothing so far as the independence of the commission is concerned whether the treasurer of the commonwealth obtains the funds for its support from one source or another. The sole question is whether these companies, rather than other public service corporations, are entitled to this exemption from taxation at the expense of all the other taxpayers of the commonwealth; and this question I am sure should be answered in the negative. The saving to the taxpayers by a return to the time-honored plan would in only four years nearly suffice to meet the entire cost of enlarging the State House to accommodate all the departments. But if the new plan is right, we should at least be consistent enough to extend it to the corporations under the jurisdiction of the Gas and Electric Light Commission, which now pay the entire cost of their regulation.

"I again urge the transfer of the supervision and regulation of telephone and telegraph companies from the Public Service Commission to the Gas and Electric Light Commission. I urgently recommend a thorough public inquiry as to telephone and telegraph rates and service in this commonwealth."

Governor Morehead of Nebraska

"The increase in population of the State and the rapid development of our towns and cities make the subject of public service corporations important. I recommend that you consider the legislation of other states, as it is unwise to pass experimental legislation or to adopt new or untried methods, when we may profit by the experience of others. I urge a careful study of the laws of these states, and that these corporations be placed under our State Railway Commission.

"I wish to urge for your consideration the proper conservation and development of our water-power. The United States War Department has perhaps the ablest engineering corps in the world, as is demonstrated by the completion of the Panama Canal. I see no reason why the people of the several states may not avail themselves of this talent, and I recommend that by joint resolution you memorialize our representatives in Congress to call upon the proper federal department and secure its aid and co-operation. Either by executive order or by federal statute I believe it possible to secure the services of a corps of suitable engineers, have them detailed to work in Nebraska, and have the most thorough investigation made, that we may know definitely what our possibilities are. Before you grant any new rights or before we embark upon the development of our water-power this information ought to be at hand."

Governor Byrne of South Dakota

"Laws should be passed giving the Board of Railroad Commissioners control of light and power companies

in the State, and generally extending their authority in the direction of a general public utilities board."

Governor Lister of Washington

"It is probable that there will be introduced for your consideration some bills providing for a curtailment of the powers of the Public Service Commission in relation to the regulation of public utilities within the boundaries of municipalities. Personally I feel that the tendency ought to be to increase rather than to decrease the power of the State commission and that to the State commission ought to be given regulative power over municipally owned utilities."

Governor Hatfield of West Virginia

"In some of the most important cases that have come before the Public Service Commission the decision has resulted in a tie vote. The possibility of such occurrences for the future should be averted by making the commission consist of an odd number of members. Having always been of the opinion that better results are obtained by concentrated responsibility, I believe that the smaller the unit in the way of numbers in the administration of any duty, so long as the duties may be consistently taken care of, the better, so that responsibility can be fixed. I, therefore, favor a body of three members instead of five. There are many amendments which should be made to the public service commission law. One of the first in importance is to amend it so that the power of the commission may be well defined as to its right to prevent any increase in any rate made by any public service corporation operating in intrastate business in this State. Additional power should be given to the commission to subpœna witnesses, take testimony, administer oaths, and this power should be given also to inspectors and special examiners when they are required by the commission to obtain information; also, the power should be extended to the commission to exercise jurisdiction over all electric, gas or water meters whereby any electricity, gas or water is sold in the State. The commission should also be given the power to punish for contempt and to require papers, evidence, books, documents, etc., to be produced without invoking the aid of the Circuit Court.

"The Public Service Commission informs me that it has not had funds available with which to investigate and determine the merits of any of the proposed applications for the construction of dams which range in height from 29 ft. to 240 ft. It is essential that the ownership of water-power be so regulated that it shall remain in the name of the State, so that the people may own and operate the dams whenever they desire so to do. If dams are to be constructed, I favor a limit, ironclad in its purpose and made plain of understanding, that no permits be authorized to any company to construct a dam that will exceed in height 40 ft., and that complete and plenary control be left to the State, with the proviso that the people at their will shall have the right to acquire and operate the same at their pleasure and that in the construction of these dams and the investigation of the application the applicant shall bear the expense, and that before a permit is granted a substantial bond or the deposit of money shall be required to indicate good faith. It is likewise important that the dam shall be supervised by the commission and the Governor be given discretion when in his opinion public policy demands, and that the State through its commission be given the power to secure the services of engineers of known ability to supervise the erection of such dams, for which the applicant company shall be compelled to pay. In case it is desired by a corporation to construct a dam higher than 40 ft. it should be provided that such permission be obtained through a special act of the Legislature."

New Substation for United Company

The United Electric Light & Power Company of New York City has in course of erection a new substation to meet the growing demands upon the company's alternating-current distributing system in the lower section of the city.

This substation, a sketch of which is shown herewith,

UNITED ELECTRIC LIGHT & POWER COMPANY'S SUBSTATION

will be erected on a lot approximately 25 ft. by 100 ft., on the south side of West Forty-fifth Street, between Eighth and Ninth Avenues. It will be of strictly fireproof construction, three-story and basement, and is designed for an equipment of approximately 10,000-kw rating, with facilities for twenty outgoing feeders. Energy will be available from this substation by about Oct. 1. This will be the fourth general substation of the company on Manhattan Island.

Temporary Service Rate at Cincinnati Extended

At a meeting of the light committee of the City Council of Cincinnati on Jan. 22 it was agreed that the present temporary rate of the Union Gas & Electric Company for energy should be extended for two months from Feb. 1. City Solicitor Schoenle criticised the Public Utilities Commission of Ohio for not completing its appraisal of the property by this time. It was stated, however, that the report on the valuation will be ready within a short time.

Miscellaneous News Notes

Investigation of Connecticut Water Resources.—The United States Geological Survey and the Connecticut Geological and Natural History Survey have co-operated in a study of ground waters as part of a thorough study of water resources of the State. Reports of some of the areas have been completed and will be published by the federal government.

The "Movie" as a Twenty-four-Hour Load.—The demand of most motion-picture shows comes at a time when the central station is carrying the peak of its evening lighting load. Two Chicago moving-picture theatres, however, are now running twenty-four hours a day. These places are largely patronized by newspaper men and other night workers, who drop in for film entertainment after the midnight hour, and the houses are said to be well filled all night long.

Time of Delivery Should Be Specified in Contracts.—A buyer cannot make time of delivery the essence of a contract without notifying the seller of his intention to cancel the order unless delivery is made before a fixed date, according to a recent decision (150 N. Y. S., 658) of the Supreme Court of New York. Moreover, the buyer accepting part of the goods after the time fixed for delivery and requesting further deliveries was held to waive the time of delivery.

Novel Legislation Proposed in Ohio.—Representative D. E. Liggitt, of Logan County, has announced his intention of presenting a bill in the Ohio Legislature that will allow municipal light and power plants to offer inducements to industries to remove to the municipalities where the city plants are established by furnishing energy to the industries at reduced rates or even free for five years. His idea would also provide for the sale of service outside the municipal boundaries.

Negligence of Company Not Established.—In an action for death caused by the decedent's coming in contact with a lowered unlighted electric street lamp (151 N. Y. S., 144) the Supreme Court of New York ruled that negligence on the part of the defendant electric-service company could not be established, as proof was insufficient to show that the lamp had been lowered more than one and a half hours. This period was not considered sufficiently long to charge the defendant with negligence because of defective maintenance.

Guaranteed Wiring Adopted in England.—At a meeting of the council of the Electrical Contractors' Association, Inc., held at Leeds, England, on Jan. 15, it was decided to adopt the guarantee scheme of wiring which has been before the association for two years, in its entirety. The association as a whole will guarantee the wiring work of each of its members individually up to a certain specified amount after Oct. 1 of this year. The standard adopted will be practically in accordance with the rules issued by the British Institution of Electrical Engineers.

International Engineering Congress, 1915.—The technical success of the International Engineering Congress to be held at San Francisco, Sept. 20-25, is now well assured. Notwithstanding the difficulties arising as a result of the war, the committee on papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing eighteen countries. The congress will therefore be international in scope and character, although the representation from Europe will naturally be less than originally planned.

Electric Company Not Required to Guard Against Remotely Possible Dangers.—In a decision (92 A., 341) recently rendered by the Supreme Court of Pennsylvania it was held that a company employing electricity, while bound to guard against injury therefrom, is under no obligation to safeguard wires which by reasonable anticipation cannot be expected to cause injury. The case arose from an injury to a child who threw a stone attached to a spool of copper wire (not belonging to the defendant) over the defendant's uninsulated distribution line and then took hold of the dangling wire.

Central Stations of Russia.—At a recent meeting of electrical engineers held in the Electrotechnical Institute of Alexander III some statistics on the central stations of Russia were given. Russia has a total of 137 central stations. Of these eighty belong to municipalities and serve 5,000,000 citizens and fifty-seven belong to concessionaires and serve 9,488,000 citizens. That is to say that, although the concession stations are so many less than the municipal stations, they serve twice the number of citizens. The stations of the concessionaires are in the industrial and densely populated districts.

Northern Ohio Traction & Light Company's Water Rights on Cuyahoga River Fixed.—Through the dismissal of the suit of the Cuyahoga Power Company by the Court of Appeals at Cleveland last week, the water rights at what is known as the gorge on the Cuyahoga River are guaranteed to the Northern Ohio Traction & Light Company of Akron, Ohio. This company completed a large combined steam and hydroelectric power plant at that point about a year ago. The Cuyahoga Power Company filed the suit some years ago on the claim that it had obtained first rights. In this decision the findings of the lower courts are affirmed.

Comforts of Electricity in Idaho.—Speaking before the convention of the Southwestern Lumbermen's Association at Kansas City, Jan. 29, Mr. C. J. Blanchard, statistician of the Reclamation Service, dwelling on the home-making features of the reclamation of arid lands in the West, told what electricity generated at the government power houses has done to improve the conditions of settlers in several regions. He said that "one project in Idaho has eighteen co-operative organizations of farmers, who buy electricity from the government at 0.5 cent per kw-hr., and their homes are lighted and heated at the final cost to the consumer of less than 3 cents per kw-hr."

Ohio Supreme Court Rules on Municipal Light Bonds.—Last week the Ohio Supreme Court rendered a decision sustaining the lower courts in the case of Director of Law John N. Stockwell of Cleveland against the City Sinking Fund Commission and two firms of bond dealers. It referred to the sale of $500,000 municipal light bonds by the commission. The two points in the decision are that it is illegal to sell bonds for less than par and accrued interest and that the sale of bonds is an abuse of the powers of the Sinking Fund Commission when it is admitted that the sale of the bonds is not necessary to meet the requirements of the sinking fund.

Creosote Plentiful.—As the result of the war in Europe considerable interest was manifested in the possibility of the depletion of the creosote supply for wood-preserving purposes in the United States. A speaker at the recent meeting of the American Wood Preservers' Association declared that of the 100,000,000 gal. of creosote used annually in this country about 60,000,000 gal. is imported from Europe. Of this amount, however, only 15,000,000 gal. comes from Germany, so that the shutting of Germany's ports will cut off only about one-seventh of the normal supply of the United States. The output of American producers can easily be increased to offset this loss. Germany is holding her creosote for fuel purposes. The delivery of creosote imports has been somewhat interfered with by the commandeering of tank ships by the British Admiralty, but a number of cargoes of creosote are now on the way across the ocean and will shortly be in the American market.

Electricity in Norway.—In the course of a lecture delivered in Christiania Mr. J. P. Nissen gave some details of electric supply in Norway. Water, he said, was the accepted source of power in that country, and from this means of energy some 6,000,000 hp was commercially available. Estimating from the progress of recent years, Mr. Nissen thought that this horse-power would be fully exploited by the year 1970. In accounting for this absorption of power the lecturer suggested that by the year mentioned the general supply of electricity would account for 1,000,000 hp, the electrochemical industry for 3,600,000 hp, the timber and other industries for 1,000,000 hp, and railways for 400,000 hp. He thus arrived at the conclusion that, progressing at the present rate, the supply of electricity for general purposes would absorb only one-sixth of the water-power. The lecturer expressed the opinion that the working of all electric-power stations in the towns by the municipal authorities was only a matter of time, and this would probably prove to be the case in rural districts where energy sold had to be distributed over a wide area.

Associations and Societies

Chicago Jovian League.—Mr. Henry A. Morse, vice-president and electrical engineer of the Simplex Wire & Cable Company, Boston, Mass., is to deliver an illustrated lecture on the manufacture of rubber-covered wires before the Chicago Jovian League, Hotel Sherman, Chicago, Feb. 15.

Ohio Electric Light Association.—The twenty-first annual convention of the Ohio Electric Light Association will be held at Cedar Point, Ohio, July 20 to 23. Mr. D. L. Gaskill, Greenville, Ohio, is secretary, and the general committee on arrangements consists of Messrs. E. A. Bechstein, Sandusky, chairman; J. T. Kermode, Cleveland; W. S. Culver, Cincinnati, and C. J. Ratterman, Cincinnati.

Dayton Section, N. E. L. A.—Employees of the Dayton Power & Light Company, Dayton, Ohio, have formed a company section of the National Electric Light Association, choosing as officers Mr. T. F. Kelly, chairman; Mr. John K. Himes, vice-chairman; Mr. J. Fitzpatrick, Jr., secretary, and Mr. L. K. Funkhouser, treasurer. Messrs. Frank M. Tait, O. H. Hutchings, O. B. Reemelin, M. H. Wagner and F. B. Steele were named as members of the executive committee. On Feb. 3 Mr. T. Commerford Martin, executive secretary of the N. E. L. A., addressed the newly formed section on the subject of membership in the organization and the coming San Francisco convention.

New York Electrical Society.—At a meeting of the New York Electrical Society to be held in the Engineering Societies Building on Feb. 17 Mr. Putnam A. Bates, electrical engineer of the New York Fire Department, will lecture on the fire-alarm system of New York City. He will give a review of the past history of the system, a recital of its present shortcomings, and a glimpse of the plans now formulated for its permanent improvement in all boroughs, through the establishment of modern methods. The subject will be illustrated by lantern slides. After Mr. Bates' lecture a demonstration will be made of improved lighting for photographic studios. The demonstration will cover both still and moving-picture work, using incandescent, mercury-vapor and arc lamps.

Institute of Radio Engineers.—At the annual meeting of the Institute, held at Columbia University on Jan. 6, the election of the following officers for 1915 was announced: President, Mr. John Stone Stone; vice-president, Dr. George W. Pierce; treasurer, Mr. Warren F. Hubley; secretary, Mr. David Sarnoff; managers, Dr. L. W. Austin and Messrs. John Hays Hammond, Jr., Robert H. Marriott, Guy Hill, George S. Davis and Roy A. Weagant. Dr. Alfred N. Goldsmith continues as editor of publications and three additional managers from the New York membership are to be appointed by the board of direction. Mr. Roy A. Weagant read a paper on "The Design and Construction of Guy-Supported Towers for Radiotelegraphy," in which he gave the fundamental stress and deformation formulas used in planning such structures. The application of the theoretical relations to the actual design of a 600-ft. tubular steel tower was shown, and the paper was followed by an interesting discussion.

Power Sales Bureau, Commercial Section, N. E. L. A.—At a meeting of the power sales bureau of the Commercial Section of the National Electric Light Association held recently in Chicago it was decided to prepare a complete day's program and arrange for a banquet at the San Francisco convention. The action of the last meeting to appoint a committee on constitution and by-laws was rescinded. The following program was offered for adoption: Morning—Report on details of organization and scope of work of power-sales bureau, by Mr. C. J. Russell; "Typical Power Sales Development in the West," by an author to be selected by Mr. G. H. Jones; report of sub-committee on electric furnaces and welding, (1) "Electric Furnaces for Operation Requiring Moderate Temperatures," by Mr. Booth, (2) "Operation of a Steel Furnace at Redondo Beach," by Mr. McKnight, (3) "Recent Developments of Arc Furnaces," by Mr. Booth, and (4) "Charges for Electric Welding Services," by Mr. C. K. Nichols. Afternoon—Demonstration of a power sale by Mr. C. H. Stevens. Evening—Banquet followed by round-table discussion and exhibition of a motion picture displaying coal-mining operations.

Public Service Commission News

District of Columbia Commission

The commission has issued regulations for electric service. Its order provides that on application and for sufficient cause shown such modifications and exemptions may be made as the facts shall warrant. Non-compliance with any of the regulations will constitute a violation of the law unless specifically authorized by order of the commission. The department of the commission which has charge of the supervision of electric service shall be called the electrical inspection bureau. The regulations are to take effect on Feb. 15, 1915, and continue in force until change or abrogation by order of the commission.

The commission has issued an order requiring utilities delivering electrical energy to commercial customers or using or delivering electrical energy for the operation of street railways to furnish information for each month concerning the kilowatt-hours generated, used and delivered during the month. The statement is to show the average price received per kilowatt-hour, the total kilowatt-hours delivered to commercial customers, used by or delivered to each electric-railway company, and used or delivered for any purpose not specifically stated otherwise. The statement is also to show the kilowatt-hours delivered for street and park lights, the total kilowatt-hours accounted for, the total kilowatt-hours unaccounted for, the total kilowatt-hours generated, and the average cost per kilowatt-hour generated.

New York Commissions

Chairman Edward E. McCall of the Public Service Commission, First District, has been the principal witness before the joint legislative committee of investigation in New York. He testified that in his judgment the volume of work is such that three members would be too few to handle it. The commission should have at least five members. The New York Telephone Company should also be under the control of the First District commission.

Chairman McCall began by saying on behalf of Chairman Willcox, his predecessor, that the change should never have been made. The contracts providing for rapid transit development would have been signed in any case and he claims no credit for them. The man who should have signed the contracts was the one whose brain was responsible for this scheme for development of the city, and that was ex-Chairman Willcox. Chairman McCall said that he was not one of those who believe the Brooklyn Rapid Transit Company officials are not doing their level best to give the best service they can. Conditions restrict them, but he believes there is no wilful disregard of orders on the part of any official that he has met. He made the same statement for the Interborough Rapid Transit Company.

It was brought out that while acting as chairman of the commission Mr. McCall has served as counsel, referee or special guardian in various legal cases. The total number of hearings or trial days involved in these cases as given out by the legislative investigating committee was fifty-seven, and the total number of commission meetings missed was thirteen. Mr. McCall stated that he would make a complete statement later.

Mr. Edward F. Boyle, who is said to be a Tammany district leader and who had been employed previously in the office of the commissioner of accounts, was employed as a special examiner to gather information for Mr. McCall in regard to the affairs of the commission, so that he should be better posted concerning the work.

According to dispatches from Albany, Governor Whitman has not yet made up his mind what course he will pursue in regard to the commission. Many protests have been filed with the Governor against the plan to create one commission to supplant the two commissions, thus taking one away from New York City.

Mr. E. H. Letchworth, attorney for the Buffalo General Electric Company, has argued before the Second District commission the company's application for permission to issue $867,471 of 5 per cent thirty-year bonds to reimburse the treasury for expenditures from income for extensions and betterments during the last two years. Mr. Paulding Foote Sellers, general manager, and Mr. Horace L. Mann, treasurer, swore to the accuracy of the company's petition.

The First District commission has established regulations for gas companies in receiving and caring for deposits made by consumers. The order requires the keeping of accurate accounts and the payment or crediting of the legal interest at 6 per cent per annum upon such deposits.

Massachusetts Commission

Representative Caro, of Chelsea, Mass., appeared before the committee on public lighting of the Massachusetts Legislature on Feb. 3 in support of a bill to abolish the Gas and Electric Light Commission and transfer its powers and duties to the Public Service Commission, on the ground that the regulation of all public utilities should be concentrated in one official body. The bill met with little favor from the committee, however, and was strongly opposed by Messrs. Everett W. Burdett, counsel of the Massachusetts Electric Lighting Association; Albert E. Pillsbury, representing the Massachusetts Gas Association, and Charles S. Davis, on behalf of the Turners Falls Power Company. Opposition was also recorded on behalf of the municipal lighting plants of the State. The speakers opposing the bill contended that thirty years' service had qualified the commission as an expert tribunal in the regulation of gas and electric utilities and that the transfer of its work to the Public Service Commission, created in 1913, would merely overload the latter body and deprive the State of the benefit of accumulated experience. Later in the day the committee sent in an adverse report on the bill.

Ohio Commission

The Howard economy committee of the Ohio Legislature has decided to recommend a reduction of the salaries of members of the commission from $6,000 to $5,000 each per year. It will also recommend that the salaries of engine and boiler inspectors be reduced from $2,160 to $1,800 per year, and that in the bureau of inspection only two men shall receive $2,500 each, instead of three, as in the past.

The proposition to combine the Public Utilities Commission and the State Tax Commission, advanced recently, is meeting with favor on the part of some utility men. With one commission only one set of reports would be needed, and this would do away with much work and expense. There is more likelihood that one valuation would be used for both rate-making and tax purposes. With the two commissions some of the companies have had their properties appraised high for tax purposes and very low in rate cases.

Pennsylvania Commission

An order has been issued by the commission providing that persons publishing orders of the commission for direction of patrons or the public must print the exact wording. The order says: "It having come to the attention of the commission that certain public service companies have been sending out written or printed notices or other such communications to their patrons in which they have attributed to the commission from time to time the making of alleged rulings, regulations or orders which in point of fact have not been made by the commission as represented, and thereby have occasioned misunderstanding, confusion and inconvenience to their patrons and the public in various matters, but especially with regard to the time and manner of payment of bills subject to discount, it is hereby ordered that the above practice shall be discontinued."

In granting a certificate of public convenience to the Blue Mountain Telephone & Telegraph Company to extend its operations in Pen Argyl, Wind Gap, Roseto and East Bangor, in Northampton County, in opposition to the protest of the Slate Belt Telephone & Telegraph Company, the commission declared that the future development of the telephone service will demand that every local community, however small, shall be given the opportunity to communicate by telephone with the State at large, and the State at large with every local community, whenever circumstances will permit such co-operative service. The protest of the Slate Belt Company was that it already occupies the territory with a telephone system, and that if permission were granted to the petitioner to enter a territory so limited in area and population the competition would seriously interfere with, if not destroy, the property values of the Slate Belt concern.

Personal

Mr. E. Dickinson has been appointed superintendent of the Kendallville (Ind.) Light & Water Plant.

Mr. H. L. Burnette has been appointed manager of the municipal electric light plant at Chicopee Falls, Mass.

Mr. C. Blackhall, of Wingham, Ont., has been appointed superintendent of the Acton (Ont.) hydroelectric system.

Mr. J. W. Irvine, of Trenton, Mo., has been appointed manager of the San Angelo (Tex.) Water, Light & Power Company as successor to the late W. H. Guthrie.

Mr. C. D. Flanigan, vice-president and general manager of the Athens (Ga.) Railway & Electric Company, has been elected president of the Athens Chamber of Commerce.

Mr. R. D. Johnson, hydraulic engineer of the Ontario Power Company, Niagara Falls, Ont., has resigned that position and opened a consulting engineering office at 60 Wall Street, New York City.

Mr. Louis Payne, former superintendent of the Virginia-Western Power Company's plant at Covington, Va., has been promoted to be general superintendent in charge of maintenance with headquarters at Clifton Forge, Va.

Mr. Charles M. Cohn, formerly vice-president of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., in charge of the gas division, has been elected vice-president in charge of both gas and electric divisions.

Mr. Walter Alexander, district master mechanic of the Chicago, Milwaukee & St. Paul Railroad, residing at Milwaukee, has been appointed a member of the Railroad Commission of Wisconsin, to succeed Mr. David Harlow, whose term has expired.

Mr. A. H. Grimsley, superintendent of the West Virginia Water & Electric Company, Charleston, W. Va., resigned Feb. 1 and accepted a position as assistant to the president and chief engineer of the Virginia-Western Power Company, Clifton Forge, Va.

Mr. R. A. Sara, sales manager of the Winnipeg (Man.) Light & Power Department, has been a visitor in Detroit, Chicago and Minneapolis investigating the accounting systems of the power companies with a view to improving, if possible, the system in use by the city of Winnipeg.

Mr. Eugene W. Stern, consulting engineer of New York City and secretary of the American Institute of Consulting Engineers, has been appointed chief engineer of the bureau of highways, borough of Manhattan, New York City. Mr. Stern is a graduate of the School of Practical Science, Toronto, Ont.

Mr. W. B. Underwood, who for the past two years has been connected with the American Sterilizer Company, Erie, Pa., in the capacity of electrical engineer, has accepted a similar position with the Wilmot Castle Company, manufacturer of sterilizers and bacteriological apparatus, at Rochester, N. Y.

Mr. G. L. Ridout, a graduate of the Royal Military College, Kingston, Ont., and for some time in the employ of the Hydro-Electric Power Commission of Ontario in charge of the erection of steel towers, has been granted a commission in the department of railways of the Royal Engineers of Lord Kitchener's army.

Mr. Thomas A. Edison was the recipient of many congratulatory letters and telegrams on Thursday, Feb. 11, when he reached his sixty-eighth birthday. All the employees of the numerous Edison companies at Orange, N. J., wore appropriate buttons and ribbons in honor of the event as has been customary for the past few years. The ELECTRICAL WORLD adds its felicitations and merely echoes the fervent hope of all humanity in wishing the great inventor long life and prosperity. May the passing years add new luster to his fame!

Mr. J. E. Aldred has resigned as president of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., but remains as chairman of the board of directors. Mr. Aldred has been succeeded by Mr. H. A. Wagner, a biographical sketch of whom appeared in last week's issue. Mr. Aldred is better known in the utility field in Canada

than in the United States, he being president of the Shawinigan Water & Power Company, Shawinigan Falls, Quebec, and Cedars Rapids Manufacturing & Power Company, Montreal, and a director of the Montreal Light, Heat & Power Company.

Mr. Arthur S. Ives was born Jan. 3, 1870, in Brooklyn, N. Y. He was graduated from the Columbia School of Mines, with the degree of civil engineer, in 1889, at the age of nineteen, and two years later received also the degree of electrical engineer from the same college. He was with the Thomson-Houston Electric Company at Lynn at the time of its consolidation with the Edison General Electric Company to form the new General Electric Company, and was subsequently on the engineering staff of the New York and Brooklyn Bridge for a number of years, in charge of important construction work. After a diversified experience in mechanical and electrical engineering as well as executive work, for manufacturing interests handling hydraulic and power-plant machinery and equipment, he became connected with the public utility business in 1907 as assistant general manager of the Poughkeepsie (N. Y.) Light, Heat & Power Company and consulting engineer for all of its allied properties, since consolidated as the Central Hudson Gas & Electric Company. In 1912 Mr. Ives, with Mr. Rolland A. Davidson, formed the engineering firm of Ives & Davidson, and he has since been engaged in consulting work with headquarters in New York City. The new firm of Cole, Ives & Davidson recently formed by them in connection with Mr. W. W. Cole, formerly general manager for Day & Zimmerman of Philadelphia, will continue the same work along broader lines. Mr. Ives' engineering experience has covered civil and mechanical as well as electrical lines, including the design and construction of structural steel and concrete work, large pumping plants, steam and internal-combustion power plants, hydroelectric development, high-tension transmission lines and electrical equipment of all kinds in various parts of the country. He has also made a special study of the subject of electric rates and central-station accounting, as well as of appraisal and valuation work for public utility properties. While at Poughkeepsie Mr. Ives served on important committees of the Empire State Gas and Electric Association. He is also a member of the American Society of Civil Engineers, the National Electric Light Association and the Illuminating Engineering Society. His first contribution to technical literature was an original thesis on the "Determination of Magnetic Leakage in Dynamos and Motors," which was published in the Jan. 2, 1892, issue of the ELECTRICAL WORLD, and which first pointed the way for the development of modern practice in such matters from the laboratory experiments of Hopkinson. His paper on 33,000-volt transmission-line specifications was read before the Chicago convention of the N. E. L. A. in 1908.

Obituary

Charles G. King, of the Bryant Bery Steam Turbine Company, Detroit, Mich., died Jan. 19.

Julius C. Sterns, president of the Sterns Electric Company, and one of Buffalo's pioneer dealers in electrical equipment and supplies, died Jan. 31, from blood poisoning caused by a carbuncle on his neck. Mr. Sterns was born in Buffalo fifty-five years ago and forsook the study of medicine to engage in the electrical business. He was a member of the board of directors of the New York State Electrical Contractors' Association and of the National Electrical Contractors' Association.

Edgar S. Strunk, for the past two years business manager of the *Lighting Journal*, New York, died at his home in Harrington Park, N. J., Feb. 9, as the result of an attack of typhoid fever. He was born in Reading, Pa., in 1878. In 1898 he became associated with the Hartford Carpet Corporation, and later was appointed superintendent at Ely, Nev., of the New York & Nevada Copper Company. He was business manager of the *Illuminating Engineer* from its organization in 1906 until August, 1912. He was for years a member of the Jovian Order and of the Illuminating Engineering Society. He leaves a wife and son.

Corporate and Financial

Seattle Lighting Company Bond Offering.—Harris, Forbes & Company of New York are offering $107,000 5 per cent refunding fourteen-year bonds due 1949 of the Seattle Lighting Company at 91½ to net 5.55 per cent.

Pacific Power & Light Bond Offering.—White, Weld & Company and William A. Read & Company, of New York, are offering at 91 and interest $1,052,000 first and refunding mortgage 5 per cent gold bonds of the Pacific Power & Light Company, Portland, Ore.

Pacific Gas & Electric Bonds.—A supplemental order of the Railroad Commission of California provides that the $5,000,000 of general and refunding mortgage gold bonds of the Pacific Gas & Electric Company, authorized on July 1, 1914, shall be sold at not less than 85.

Amsterdam Edison Electric Light & Power Growth.—The output of the Edison Electric Light & Power Company of Amsterdam, N. Y., was 2,408,065 kw-hr. in 1911 and 6,247,068 kw-hr. in 1914. In the same period the total connected load has grown from 2632 kw to 6957 kw.

Second Time Extension.—The time limit set for the exchange of stock of the Westinghouse Machine Company for Westinghouse Electric & Manufacturing Company stock has been extended again a week to Feb. 17. Approximately 90 per cent of machine stock has been exchanged to date.

Canton Electric Company to Issue Bonds.—The Canton (Ohio) Electric Company has been authorized by the Public Utilities Commission of Ohio to issue $115,000 first and refunding mortgage 5 per cent sinking-fund gold bonds, at not less than 85. The proceeds will reimburse the treasury in part for $144,988 expense during the thirteen months ended Oct. 31, 1914, for additions, extensions, improvements and betterments.

Dayton Company Earnings.—The annual report of the Dayton (Ohio) Power & Light Company for the year ended Dec. 31, 1914, shows an operating ratio of 55.85 as compared with 60.43 in the previous year. The output for the year was 35,827,532 kw-hr., an increase of 7,125,362 kw-hr. The statement follows:

	1914	1913
Cross earnings	$945,563	$734,769
Expenses	518,551	425,620
Net earnings	$427,012	$309,149

Springfield Gas & Electric Election.—The following officers were elected recently by the Springfield Gas & Electric Company: Messrs. B. C. Cobb, president; John W. Bun, vice-president; A. D. Mackie, vice-president and general manager. The following were elected directors: Messrs. J. F. Miller, George Reisch and William Ridgely. The company is controlled by the Union Railway, Gas & Electric Company, which is controlled through stock ownership by the Commonwealth Power, Railway & Light Company, which in turn is operated by Hodenpyl, Hardy & Company, of New York.

Puget Sound Traction, Light & Power Purchases Land.—The Puget Sound Traction, Light & Power Company, Seattle, Wash., recently purchased some land, including riparian rights, in Skagit County, Wash. A statement was made by the Stone & Webster Management Association that the purchase was for the purpose of ultimate power development and to provide water-power facilities for a large commercial undertaking. It is the company's hope that the eventual development will be made at a very low figure so that rates for energy can be made attractive to industrial concerns.

United Light & Power Reorganization.—A majority of the holders of the $1,618,000 three-year 6 per cent collateral trust notes of the United Light & Power Company of New York have agreed to a plan of reorganization, it is reported, under which they will accept 90 per cent of their holdings in 5 per cent bonds of a new corporation, the Consolidated Electric Company, which will operate as a subsidiary of the Great Western Power Company. The holders of the outstanding bonds are to receive par for that issue. A large number of the bonds, and also of the notes, have been deposited with the Anglo-California Trust Company. Including notes which have been promised, the total that is now pledged to the plan is $1,400,000.

Mount Whitney Power & Electric Elections.—At a recent meeting of directors of the Mount Whitney Power & Electric Company, of Visalia, Cal., the following officers were elected: Messrs. Harris Hammond, president; Ben M. Maddox and S. Mitchell, vice-presidents; Patrick M. Longan, treasurer and comptroller; E. E. Baker, secretary. Together with the officers the following serve as directors: Messrs. W. R. Spaulding and Charles R. Blyth.

New England Power Merger.—Stockholders of the New England Power Company of Maine and the Connecticut River Power Company of Maine have been asked to vote on the consolidation of the two companies and the New England Company of Massachusetts by merger into the New England Company. It was suggested to stockholders that the New England Company have class A stock to represent preferred stock of the Connecticut River Power Company of Maine, class B stock to represent common stock of the Connecticut River Power Company of Maine, and class C stock to represent preferred and common stock of the New England Power Company, and that ultimately the two Maine corporations be dissolved.

Western Electric Business.—The sales of the Western Electric Company for the year ended Dec. 31, 1914, were $66,400,000, which compares with $77,500,000 in the previous year, a decrease of approximately 14 per cent. The company enters the new year with $4,500,000 less business on its books than at the same time last year. The export sales of the Western Electric Company, and naturally the sales of the companies in Europe allied with the Western Electric Company, have been much affected by the war. The business in Mexico has been seriously affected by the unstable conditions existing there for some time, while the sales to South America and other neutral countries have decreased because of the decrease in general business and the hesitation in financing new undertakings or the extension of old ones.

American Light & Traction Earnings.—A statement of the earnings for the year ended Dec. 31, 1914, together with that for the previous year, is shown herewith. During the year gas rates and electric rates were reduced, coal and oil costs and taxes increased, the total loss in revenue from these factors over 1913 being $411,722. This accounts for the decrease in earnings. The number of electric meters increased 4131, and the output increased 12.48 per cent, or 5,006,014 kw-hr.

	1914	1913
Earnings on stocks of subsidiary companies owned by this company	$3,714,960	$3,751,976
Miscellaneous earnings	717,420	714,257
Gross earnings	$4,432,380	$4,466,233
Expenses	157,293	123,107
Net earnings	$4,275,087	$4,343,126
Surplus and reserve, previous year	9,495,882	8,689,293
Total surplus earnings	$13,770,969	$13,032,419
Cash dividends on preferred stock	$854,172	$854,172
Cash dividends on common stock	1,478,880	1,341,183
Stock dividends on common stock	1,478,880	1,341,182
Total dividends	$3,811,932	$3,536,537
Surplus balance	9,959,037	9,495,882

Consolidated Power & Light Annual Statement.—The annual statement of the Consolidated Power & Light Company of Deadwood, S. D., for the year ended Dec. 31, 1914, is as follows:

	1914	1913
Gross earnings from operation	$316,324	$277,799
Operating expenses	143,910	128,265
Net earnings from operation	$172,414	$149,534
Income from interest	181	775
Dividends from preferred stock held by trustees for benefit of company	4,200	4,200
Total net earnings	$176,795	$154,509
Allowance for depreciation	31,632	27,780
Balance for interest and surplus	$145,163	$126,729
Interest on funded debt	80,873	83,042
Net profit	$64,290	$43,687
Dividends on preferred stock	31,800	31,800
Surplus	$32,490	$11,887

Mount Whitney Power & Electric Cumulative Preferred Stock.—Blyth-Witter & Company, of San Francisco, are offering at 95 and accrued dividend first preferred 7 per cent cumulative stock of the Mount Whitney Power & Electric Corporation of New York. The company has $500,000 first preferred 7 per cent cumulative stock, $550,000 second preferred 7 per cent cumulative stock, and 21,750 shares of common stock without par value. The company has no bonded or floating debts and owns all stock of the Mount Whitney Power & Electric Company of Visalia, Cal.

Northern States Power Earnings.—Earnings for the year ended Dec. 31, 1914, of the Northern States Power Company, Chicago, Ill., including five months' earnings of the Sioux Falls division, are as follows:

Gross earnings and miscellaneous income	$4,407,766
Operating expenses and taxes	2,030,894
Net earnings	$2,376,872
Fixed charges	1,352,158
Surplus	$1,024,714
Preferred stock dividends	587,069
Balance	$437,645

American Cities Director's Impression of Properties.—At the request of the executive committee of the board of directors of the American Cities Company, Mr. Frank B. Hayne, one of the directors, submitted the impressions which he gathered on a recent trip of inspection of subsidiary properties. Mr. Hayne said: "It looks as if for some time the management of these properties will be directed toward efficiency in operation and maintaining them in their present satisfactory physical condition, rather than toward extension work, which has been so necessary in the past. It is now a more important question of fully developing the available business for which the system has been so adequately equipped." He stated that he felt that his own confidence in the future of the several properties was founded on sounder prospects than at any other time since he had been interested in the company. He also stated that he thought a visit of the directors to the properties at least once a year would not only result in more thorough knowledge on the part of the directors in regard to the properties, but would assure the fullest co-operation of the leading citizens of each community.

Northern Ohio Traction & Light Annual Report.—In the annual report of the Northern Ohio Traction & Light Company of Akron, Mr. H. A. Everett, president, stated that the additional lighting and power contracts from new customers amounted to 9334 hp and that the company made an average gain of 175 new customers during each month of the year. The number of stockholders increased from 15,009 to 18,013. Out of the total expenditure of $740,896 for additions and improvements $191,079 was used for power house and equipment and $188,018 for light and commercial power additions. The output increased 29 per cent, or from 57,903,294 kw-hr. to 74,739,133 kw-hr. The statement for the years ended Dec. 31, 1913 and 1914, is shown herewith:

	1914	1913
Gross earnings for year	$3,636,085	$3,284,533
Operating and taxes	2,237,429	2,019,654
Net earnings	$1,398,656	$1,264,879
Applied to payment of interest	606,898	561,816
Available for company's uses	$791,758	$703,063
Dividends on preferred stock	182,364	152,738
Dividends on common stock	450,000	450,000
Surplus	$159,394	$100,325

Annual Report of Continental Gas & Electric Corporation.—The annual report of the Continental Gas & Electric Corporation, Cleveland, Ohio, for the year ended Dec. 31, shows that additions and betterments of $992,949 were made. The additions included the purchase of control of the Oakland (Ia.) Electric Company, the Nebraska Gas & Electric Company, the Iowa Gas & Electric Company and the Avoca (Ia.) Electric Light & Power Company. Mr. C. S. Eaton, the president, stated that the company had a year of unusual prosperity and that the communities served had not been affected by the unsettled conditions that have obtained elsewhere. Following is a summary of the company's operations:

	1914	1913
Gross earnings	$550,330	$321,052
Operating expenses	352,868	184,918
Interest on outstanding bonds of subsidiary companies	5,790	5,790
Balance	$191,672	$130,344
Interest on company's outstanding bonds	64,525	37,125
Balance	$127,147	$93,219

Cataract Power & Conduit Company Annual Report.—The annual report for the year ended Dec. 31, 1914, for the Cataract Power & Conduit Company is as follows:

	1914	1913
Earnings	*$1,770,323	$1,729,779
Expenses:		
Niagara energy purchased	$925,589	$916,376
Other expenses	307,672	280,835
Total expenses	$1,233,261	$1,197,211
Net earnings	$537,062	$532,568
Other income:		
Interest revenues	26,100	26,159
Net income	$563,162	$558,727
Deduct:		
Bond interest	$69,200	$69,200
Other interest	74	41
Taxes	76,822	70,709
Miscellaneous rent deductions	950	950
Fixed charges, etc	$147,046	$140,901
Surplus income for year	416,116	417,826

*Included in these earnings are $378,599 for 1914 and $249,652 for 1913, representing the reduction in revenue for the respective years if rates as ordered by the Public Service Commission effective from May 1, 1913, are finally upheld.

British Westinghouse Buys French and Italian Companies.—The Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., has sold its interest in its French subsidiary, the Société Anonyme Westinghouse of Paris, to the British Westinghouse Electric & Manufacturing Company, Ltd. The sale includes the control of the Italian subsidiary, the Societa Italiana Westinghouse, which was held by the French company. The American company receives in exchange for its holdings in the French company certain British traction and railroad securities, and since the American company holds controlling interests in the British company, it will lose no control over the other companies by this sale. The consolidation of the European companies has been under consideration for a long time. The separation of companies which were practically under one control does not allow of the practice of many economies of operation made possible by a consolidation. Under the consolidation the home office can apportion contracts to those factories best fitted by location or equipment to turn out that particular order. The European companies are in excellent condition, and it has been stated by Mr. Guy E. Tripp, chairman of the board of the American company, that they are at present enjoying a better business than the American company. The valuation of approximately $8,000,000 has been placed upon the French and Italian companies.

Niagara Falls Power Annual Report.—The annual report of the Niagara Falls (N. Y.) Power Company and the Canadian Niagara Power Company for the year ended Dec. 31, 1914, showed for the first time a decrease in the yearly surplus, the decrease being $100,000. Of this $20,000 was due to the continued suspension during the entire year of dividends by the Cataract Power & Conduit Company and the Tonawanda Power Company. The decrease in interest earnings amounted to $13,000 and the increases in taxes in Canada and the United States amounted to $19,400. A decrease of $39,461 in net earnings from operation was due to the action of the Dominion government in further restricting exports of energy by the Canadian company to the United States, to the compliance on the part of the American company with a notice of the Secretary of War, dated May 28, 1914, to the effect that the measurement of water by the daily diversion method of the international waterways treaty should not be allowed and requiring the reinstatement of the momentary peak measurement of the expired Burton law, and to the depression in the business of certain customers. The combined earnings statement of the two companies follows:

	1914	1913
Gross earnings	$2,675,974	$2,742,192
Operating expenses	513,509	540,265
Net earnings	$2,162,465	$2,201,927
Other income	82,887	116,058
Net income	$2,245,352	$2,317,985
Deduct:		
Interest	$994,760	$994,760
Taxes	213,564	194,162
Insurance	12,043	10,280
Canadian Park rental	55,442	48,674
Fixed charges, etc	$1,275,809	$1,247,876
Surplus income for the year	969,543	1,070,109

Manufacturing and Industrial

The R. Thomas & Sons Company, 61 Broadway, New York, has appointed Mr. R. H. Anthony on its selling force.

The Wagner Electric Manufacturing Company, St. Louis, Mo., has appointed Mr. A. C. Gardner, formerly with the Rumsey Electric Supply Company, Ltd., of Philadelphia, as one of its salesmen.

Mr. W. P. Naser has been appointed Pacific Coast representative of the Trumbull Electric Manufacturing Company, Plainville, Conn., and has opened offices at 595 Mission Street, San Francisco, Cal.

The Electric Controller & Manufacturing Company, Cleveland, Ohio, has appointed the O. H. Davidson Equipment Company, Ideal Building, Denver, Col., as its representative in Colorado, Utah, Montana, Wyoming, South Dakota, New Mexico and Arizona.

Paul H. Jaehnig, Inc., Newark, N. J., is the name of a recently incorporated concern, the business of which was formerly conducted by Mr. Paul H. Jaehnig. The officers of the new concern are: President, F. H. Walsh; treasurer, P. H. Jaehnig and secretary, Leonia W. Jaehnig.

David A. Wright, formerly with the Yale & Towne Manufacturing Company, New York, has established himself as manufacturer's agent at 140 South Dearborn Street, Chicago, Ill. Mr. Wright is specializing on labor-saving and pneumatic machinery, cranes, hoists and trolley systems.

Packing for Export.—The Bureau of Foreign and Domestic Commerce has issued an illustrated pamphlet entitled "Packing for Export," which is designated as Miscellaneous Series No. 5. The pamphlet contains suggestions for the preparation of American merchandise for shipment to foreign countries.

The Krantz Manufacturing Company, Brooklyn, N. Y., is the name of the concern formerly known as the H. Krantz Manufacturing Company. Mr. H. Krantz is president and treasurer and Mr. W. M. Moore vice-president and secretary of the company. The board of directors of the new company for the first year is composed of Messrs. W. E. Rice, David H. Smith, W. M. Moore, W. G. Creamer and H. Krantz.

Mr. B. C. Eagon, who for seven years has been sales agent for the Burroughs Adding Machine Company in St. Louis and in other territories, has accepted a position as Canadian sales manager for the Hughes Electric Heating Company of Chicago. The Hughes company is erecting a new factory at Toronto to take care of its eastern Canadian trade, and when this factory is placed in operation about March 1 Mr. Eagon will have headquarters at Toronto.

The Jefferson Electric Manufacturing Company, 847 West Harrison Street, Chicago, Ill., has recently been formed by Mr. J. A. Bennan, formerly treasurer and general manager of the Thordarson Electric Manufacturing Company. The new company, it is reported, will manufacture a complete line of bell-ringing, toy, sign-lighting and welding transformers, battery switches, steel battery-box outfits, make-and-break and jump-spark ignition coils, and various types of high-tension transformers for testing, laboratory and research work.

Appliance Company Takes Larger Assembling Plant.—The Hotpoint Electric Heating Company has moved its Chicago office and assembling factory from 1001 West Washington Boulevard to 2240 Ogden Avenue. In the new location the company will occupy approximately 2500 sq. ft. more floor area than was available at the old plant. Heavy punch presses and other machines are now being installed at the new plant, and it is reported that some manufacturing processes in addition to assembling will in the future be carried on in Chicago.

Advertising Helps for the Fan Dealers.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is sending to the dealers announcements for its fan-selling campaign. To assist the dealer the company has prepared various kinds of mailing folders, billboard posters, street-car cards, window signs, newspaper electrotypes, lantern slides, etc. In order that the dealer may be able to approach the various classes of customers with appropriate advertising literature, six special folders have been

prepared. One folder deals exclusively with fans for the home, another with fans for the office, another for the store, another for the hotel, another for the restaurant, and another for the theater. The arguments in each folder are directed particularly to the kind of customer that should receive it, and suggestions are made in each for the proper ues of fans for each application.

The Specialty Sales Company, 261 Broadway, New York, which was recently formed by Mr. W. G. Solomon and Mr. C. H. Brown, is in the business of exporting electric and plumbing supplies. The company is also prepared to act as selling agent in New York and vicinity. The company has recently received inquiries from London and Petrograd. The inquiry from England covers carbon electrodes, insulating material, glass tubes for blowing incandescent lamps, automobile accessories, porcelain articles, electric fans, telephone parts, storage batteries and vacuum cleaners.

Salesmen's Convention.—The ninth annual salesmen's convention of the National Carbon Company will be held at Factory "A," Cleveland, Ohio, Feb. 23-26 inclusive. Nearly 200 employees, representing the management, sales and engineering departments of the nine factories of the company, will be in attendance. An extensive program of papers has been prepared on the following general subjects: Advertising and selling, illumination, carbon brushes, dry cells and storage batteries. Practical demonstrations will be given daily in which the new features and uses of the company's product will be explained.

Officers Re-elected at Annual Meeting.—The General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y., held its annual meeting Jan. 27, and the following officers were re-elected: President, Mr. Joseph Steinberger; vice-president, Mr. E. J. Kaltenbach; treasurer, Mr. James B. Stephens, and secretary and manager, Mr. V. C. Steinberger. The reports to the stockholders show that the business of the company has been affected by the European war to a certain extent; still business during 1914 did not fall much below that of the previous year, which was the banner year for the company in net returns and gross sales. The company reports that the outlook for the coming year seems very bright.

Beardslee Chandelier Manufacturing Company.—Mr. E. M. Smith, who was organizer and general manager of the Multilux Illuminating Company, of Cleveland, Ohio, has become manager of the commercial lighting department of the Beardslee Chandelier Manufacturing Company, of Chicago. In his new position Mr. Smith will devote much of his time to bringing out a line of new commercial lighting fixtures and specialties. Before organizing the Multilux Illuminating Company Mr. Smith had considerable experience in several branches of the electrical business. Early in his career he was vice-president of an electrical contracting firm in Oakland, Cal., known as the Pacific Central Electric Company, which has since gone out of existence. Later he spent several years with the Westinghouse Electric & Manufacturing Company as manager of the lamp division in the Cleveland office.

Large Order for Lighting Fixtures.—The Dale Lighting Fixture Company, 107 West Thirteenth Street, New York, recently received an order for 13,000 lighting fixtures for the Equitable Building, in that city. For this installation a new unit has been developed. The fixture is called the "Broadway" unit and is so designed that with the necessary attachments it can be made into a direct-lighting, indirect-lighting or semi-indirect-lighting unit. For the above order 6000 units will be for semi-indirect lighting. For this purpose a six-panel alabaster bowl will be utilized. The remaining 7000 fixtures will be for direct lighting and will be equipped with a "melilite" glass reflector manufactured by Gillinder & Sons, Inc., of Philadelphia, Pa. The above company also recently supplied 800 fixtures for installation in the Fairbanks Apartments, Philadelphia, and 500 special fixtures for the Leonori Hotel, Madison Avenue and Sixty-first Street, New York.

Demand for Arc-Lamp Controller.—The Speed Controller Company, 257 William Street, New York, reports that it is selling a number of its arc-lamp controllers. This device was described in the ELECTRICAL WORLD of Oct. 24, 1914. It has been installed in the American Bank Note Company's plant, the Vitagraph Theater, the Strand Theater, the Broadway Theater, the Schuyler Theater, the Jefferson Theater, the Eighty-first Street Theater and the Claremont Theater of New York City. It is also being used by the Precision Machine Company, the Nicholas Power Company, the William Fox Amusement Company, the R. & E. Singing Picture Company and the Academy of Music. Some of the other amusement places where it has been installed are the Stanley Theater of Philadelphia, the Strand Theater of Newark, the Lyceum Theater of East Orange, N. J., and the Regent Theater of Buffalo. As already noted in these columns, eight of the arc-lamp controllers have been ordered by the government for use at the Panama-Pacific International Exposition.

Orders for Gas Engines.—The United States Paper Goods Company, Cincinnati, Ohio, has recently placed an order for a 90-hp, four-cylinder gas engine, and the McJunkin-Straight Dairy Company, Pittsburgh, Pa., for a 150-hp gas engine with the Bruce-Macbeth Engine Company, Cleveland, Ohio. These engines are equipped with apparatus for generating steam from the heat generated in the water jackets. The generation of steam is performed according to the so-called Meriam steam process, which was described in the ELECTRICAL WORLD of Nov. 7, 1914, page 925. The following orders have also been received by the above company. The Magnolia Petroleum Company, Fort Worth, Tex., one 150-hp natural-gas engine; the Ingersoll-Gaulkler Company, Detroit, one 60-hp natural-gas engine for direct connection to a generator; the Solar Electric Company, Brookville, Pa., one 90-hp natural-gas engine; the Empire Marble Company, Cleveland, one 90-hp natural-gas engine; the Alhambra Theater, Sandusky, Ohio. one 40-hp natural-gas engine for direct connection to a generator.

Motor Manufacture Shown in Moving Pictures.—The manufacture of electric motors at the Lynn (Mass.) plant of the General Electric Company is shown in moving pictures which are being exhibited under the company's auspices before meetings of electrical men. A little sketch with a factory owner in the principal rôle precedes the demonstration of the plant production methods. In the opening scene a motor salesman is shown calling at the prospective customer's office, but the reception which meets him is an unresponsive one. Returning later, however, the salesman receives a more cordial greeting and extends an invitation to the factory owner to accompany him to the Lynn plant that he himself may see the careful processes employed to make motors durable and dependable. After a trip through the Lynn plant the factory owner is conducted to the company's office and there is shown in the act of signing an order for a complete motor equipment for his own plant. In the final scenes the factory owner is shown at his desk smiling and apparently free from all the worries which had beset him when his plant was full of countershafts and belting stretched in every direction.

NEW YORK METAL MARKET PRICES

	Feb. 2 Selling Prices Bid	Feb. 2 Selling Prices Asked	Feb. 9 Selling Prices Bid	Feb. 9 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot*	63 17 6		62 10 0	
Prime Lake	14.75 to 15.00		14.50 to 14.75	
Electrolytic	14.60 to 14.70		14.50 to 14.60	
Casting	14.25 to 14.50		14.00 to 14.25	
Copper wire base	15.75 to 15.87½		15.75 to 15.87½	
Lead	3.80		3.80	
Nickel	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f.o.b. smelter	10.00		11.50	
Spelter	8.00 to 8.12½†		.... to 8.00†	
Straits tin	38.00		36.12½	
Aluminum, 98 to 99 per cent.	18.75 to 19.25		19.00 to 19.50	

*OLD METALS

Heavy copper and wire	12.50	12.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	3.60	3.60
Zinc, scrap	5.37½	5.37½

COPPER EXPORTS

Exports of copper in form of pigs, ingots, bars, plates, and scrap for week ended Jan. 30, 1915.....15,389,322 lb.

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Williams & Freeman Water & Light Company, of Murfreesboro, Ark., has been incorporated with a capital stock of $10,000. J. E. Williams is president.

The West Rockhill Township Electric Light & Power Company, of Quakertown, Pa., has been incorporated with a capital stock of $5,000 by C. N. Wagner, A. H. S. Cantlin and H. R. Fehr, all of Allentown.

The Lower Macungie Township Electric Light & Power Company, of Allentown, Pa., has been chartered with a capital stock of $5,000. The incorporators are C. N. Wagner, A. H. S. Cantlin and H. R. Fehr, all of Allentown, Pa.

The Milford Township Electric Light & Power Company, of Quakertown, Pa., has been granted a charter with a capital stock of $5,000. The incorporators are C. N. Wagner, A. H. S. Cantlin and H. R. Fehr, all of Allentown.

The Lower Milford Township Electric Light & Power Company, of Allentown, Pa., has been granted a charter with a capital stock of $5,000. The incorporators are C. N. Wagner, A. H. S. Cantlin and H. R. Fehr, of Allentown, Pa.

The Public Light & Power Company, of Worcester, Mass., has been incorporated with a capital stock of $5,000,000 for the purpose of carrying on outside of the State of Massachusetts the business of generating, buying, dealing, leasing, transmitting and distributing gas, electricity and water for light, heat, power and other purposes. The officers are Philip B. Sawyer, of Elmira, N. Y., president; Farrand S. Stranahan, of Providence, vice-president and treasurer, and W. Emory Wardwell, 29 Sever Street, Worcester, assistant treasurer and clerk.

New Industrial Companies

The Six-in-One Fuse Company, of New York, N. Y., has been incorporated with a capital stock of $100,000 by C. C. Balassa, J. C. Beecher, of Manhattan, and J. P. Payor, of the Bronx. The company intends to manufacture fuse plugs and do general electrical work.

The Wile Electric Furnace Company, of Pittsburgh, Pa., has been incorporated by Raymond S. Wile, C. R. Buchzert, L. Wile and George J. Buchzert, all of Pittsburgh. The company is capitalized at $100,000 to manufacture electric fans and other appliances and devices.

The Linsham Photocinephone Corporation, of Hillsdale, N. J., has been incorporated by D. Postanji, F. Chadinli, T. I. Haubner and H. H. Plotkin, of Hillsdale. The company is capitalized at $150,000 and purposes to manufacture and deal in electrical talking moving pictures.

The Linquest Electric Company, of Jamestown, N. Y., has been incorporated by W. L. Linquest, O. B. Linquest and H. M. Lund, of Jamestown. The company is capitalized at $25,000 and intends to do a general electrical contracting business and also to deal in equipment and supplies.

The Mesinger-Whitney Electric Company, of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture electrical appliances, etc. The incorporators are: H. Mesinger, 1519 Bryant Avenue, the Bronx; F. Mesinger, of the Bronx, and P. B. Whitney, of Manhattan.

The X-Ray Tube Company, of New York, N. Y., has been incorporated by Alexander H. Jackson, Otto A. Roensch and Mortimer F. Davis, 118 East Eighty-seventh Street, New York. The company is capitalized at $10,000 and purposes to manufacture X-ray tubes, vacuum glass, chemical glassware, etc.

The American Electric Talking Sign Company has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $100,000, for the purpose of manufacturing electrical signs for advertising. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington.

The Hage-McKay Manufacturing Company, of Great Falls, Mont., has been incorporated by D. McKay, of Glasgow; Oscar Hage and R. R. Hage, of Great Falls. The company is capitalized at $30,000 to carry on any and all kinds of manufacturing, commercial, mechanical, electrical, industrial and other businesses.

Trade Publications

Loom Clip.—The Christo Manufacturing Company, Richmond, Va., has prepared a leaflet which describes its "Bulldog" loom clip.

Electric Drill..—The Electric Tachometer Company, Perry Building, Philadelphia, Pa., has prepared a leaflet which describes its electrically operated drills.

Tilting Wire Reel.—Bulletin No. 53, prepared by the A. H. Nilson Machine Company, Bridgeport, Conn., describes and illustrates several types of tilting wire reels.

Feed-Water Regulator.—The Kitts Manufacturing Company, Oswego, N. Y., is sending out a leaflet which describes and illustrates its safety feed-water regulator.

Tachometers.—The Electric Tachometer Company, Perry Building, Philadelphia, Pa., is sending out a leaflet which describes its electric tachometers for marine service.

Rebuilt Motors and Generators.—The Fuerst-Friedman Company, 1614 Columbus Road, Cleveland, Ohio, is sending out a booklet which lists a number of rebuilt motors and generators.

Lighting Standards.—The Ornamental Lighting Pole Company, 113 Liberty Street, New York, has issued a pocket-size catalog which lists a number of different types of ornamental lighting poles.

Tachometers.—James G. Biddle, 1211 Arch Street, Philadelphia, Pa., has just issued Bulletin No. 805, entitled "Jagabi and Tachometers," and Bulletin No. 810, entitled "Jagabi Electromagnetic Tachometers."

Copper-Base Alloy for Die Casting.—The McGill Metal Company, of Valparaiso, Ind., has published a bulletin describing the composition, properties and process of manufacture of its "McGill metal" die castings.

Sign Lighting.—"Engineering Features of Electric Sign Lighting" is the title of Bulletin 15A, just issued by the engineering department of the National Lamps Works of the General Electric Company, Cleveland, Ohio.

Flashlamps.—Catalog A-225 issued by the American Ever Ready Works of the National Carbon Company of New York contains illustrations and information on various types of flashlamps and other electrical devices.

Transmission-Line Devices.—The G & W Electric Specialty Company, 6308 Blackstone Avenue, Chicago, Ill., has recently issued a folder entitled, "Figure It on This Line," which contains information on pole-line devices.

High-Tension Indoor Equipment.—Bulletin No. 15 published by the Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., describes and illustrates a number of types of switches, fuses, choke coils, etc.

High-Voltage Outdoor Substation Equipment.—The Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., recently issued its Bulletin No. 20, the subject of which is outdoor substation equipment with high ratings.

Ventilating Apparatus.—The American Blower Company, Detroit, Mich., has issued a bulletin designated as No. 27, Series 3, which describes the ventilating apparatus in the Fletcher Savings & Trust Company Building, Indianapolis.

Lighting Fixtures.—The Multi-Lux Illuminating Company, 6712 Union Avenue, Cleveland, Ohio, has recently issued a catalog describing various types of direct and semi-indirect fixtures and show-window and showcase lighting devices.

Electric Tools.—A so-called general utility tool mounted on a pedestal and a suspended device which can be used as a drill, buffer or grinder are described and illustrated in leaflets recently prepared by the Stow Manufacturing Company, Binghamton, N. Y.

Sales Help for Fan-Selling Campaign.—The Diehl Manufacturing Company, Elizabeth, N. J., has recently issued a folder entitled "Diehl to Dealer Sales Help." The folder describes various methods which the above company has inaugurated to assist the dealers in selling fans.

Single-Phase Motors.—The Century Electric Company, St. Louis, Mo., has issued a bulletin showing applications of single-phase motors to bakers' machinery, vacuum cleaners, air compressors, bilge and irrigating pumps, feed-mill machinery, hoists and heating and ventilating fans.

Construction News

New England

BAR HARBOR, MAINE.—The installation of a municipal electric-light plant in Bar Harbor is under consideration.

MANCHESTER, N. H.—The W. H. McElwain Co. is planning to build an addition to its central plant and also to enlarge the power plant, to cost approximately $100,000.

BRATTLEBORO, VT.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 22 for the construction, including mechanical equipment (except elevators, lighting equipment and approaches), of the United States post office at Brattleboro. Drawings and specifications may be obtained at the above office or from the custodian of site at Brattleboro.

AMHERST, MASS. — Application has been made to the State Gas and Electric Light Commission by the Amherst Pwr. Co., of Greenfield, and the Turners Falls Co., of Turners Falls, for permission to consolidate under the name of the Turners Falls Pwr. & El. Co., with a capital stock of $2,925,000. The Turners Falls Co. is the generating company, and the Amherst Pwr. Co. the distributing company. Philip Cabot, of Boston, is president of both companies.

COLD BROOK SPRINGS, MASS.—Guy C. Allen, proprietor of the Eagle Inn, is contemplating the installation of a private plant to supply electricity for the inn. The proposed plant will be driven by a gas engine.

EAST HAMPTON, MASS.—Plans are being considered by the town officials for the installation of a municipal electric-light plant. It is proposed to utilize the Manhan pumping station, which now supplies power for the water department.

GREENFIELD, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 15 for construction (including mechanical equipment, except elevator and lighting fixtures) of the United States post office and court house in Greenfield, Mass. Drawings and specifications may be obtained at the above office or from the custodian of site at Greenfield.

SPRINGFIELD, MASS.—Bids, it is understood, will soon be asked by E. J. Parlett, architect, for the Commercial High School, for furnishing lighting fixtures for the new school building.

Middle Atlantic

BUFFALO, N. Y.—The Public Service Commission has granted the International Ry. Co., of Buffalo, permission to construct a high-speed railway from Buffalo to Niagara Falls. The cost of the proposed railway is estimated at about $2,000,000, of which $78,700 will be used for substation equipment and $109,850 for buildings; $127,837 for track, line and grading, and $160,000 for rolling stock.

CENTER VILLAGE, N. Y.—The Public Service Commission has granted the Afton-Windsor Lt., Ht. & Pwr. Co., of Center Village, permission to issue $35,000 in bonds, to be sold at not less than 90, the proceeds to be used for purchase of turbines and water-wheels, completion of power houses and electric generating, transmitting and distribution equipment.

DUNKIRK, N.Y.—The Dunkirk El. Mfg. Co. is planning to install two new boilers, having a total capacity of 450 hp.

ITHACA, N. Y.—Bids will be received by E. L. Williams, comptroller, Cornell University, Ithaca, until Feb. 23 for construction, including heating and plumbing and electrical work, of greenhouses at the New York State College of Agriculture, Cornell University, Ithaca. Drawings and specifications may be seen at the New York State College of Agriculture, Cornell University, Ithaca; New York office of the Department of Architecture, Room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y.

NEWARK, N. Y.—Bids will be received by Dr. Henry H. Stebbins, president board of trustees, New York State Custodial Asylum for Feeble-Minded Women, Newark, N. Y., for construction of cottage (for 92 inmates), including heating, plumbing and electrical work, at the New York State Custodial Asylum for Feeble-Minded Women. Drawings and specifications may be seen at the New York State Custodial Asylum for Feeble-Minded Women; the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 18 for construction of three buildings for the Acute Hospital, having a capacity of 100 patients, 150 patients and 200 patients respectively, including heating, plumbing and electric work for each building, at the Manhattan State Hospital, Ward's Island, N. Y. Drawings and specifications may be seen at the Manhattan State Hospital, Ward's Island; the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

SENECA FALLS, N. Y. — Water-power owners of Seneca Falls and the Canal Board have reached an agreement whereby the former are to have the privilege of exercising power rights at the new barge canal dam. The claims for physical property damage, which are before the Board of Claims, will be settled for $617,748. A company will soon be formed under the name of the Seneca Falls Pwr. Corpn. to build a hydroelectric plant at the dam, which it is estimated will develop about 7500 hp. The power station is to be situated on the new 50-ft. dam and will cost upward of $200,000.

SILVER SPRINGS, N. Y.—The village of Silver Springs expects to duplicate the equipment of the municipal electric-light plant within the next 12 months. James E. Nash is president of the village of Silver Springs.

WEST HAVERSTRAW, N. Y.—Bids will be received for the construction of the new hospital building, including heating, plumbing, drainage, electrical work and electric elevator, at the New State Hospital for Crippled and Deformed Children, West Haverstraw. Drawings and specifications may be consulted at the New State Hospital for Crippled and Deformed Children, West Haverstraw, at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany.

BEALLSVILLE, PA.—The West Penn El. Co., of Pittsburgh, has submitted a proposal to the Town Council offering to supply electricity to light the town and for commercial purposes. The proposition provides for 20 lamps of 100 cp for lighting the streets.

BOSWELL, PA.—The Randolph Coal Co., of Boswell, is installing an electric plant to operate the machinery in its mine.

BRISTOL, PA.—Plans are being considered for improving the lighting system on Mill Street in the business section.

EASTON, PA.—In his annual report to the City Council T. P. Ricker, fire chief, has recommended that all fire-alarm circuits in the business section of the city be placed underground.

HARRISBURG, PA.—Application has been filed with the State Department for charters for the following companies: The Garrett El. Lt., Ht. & Pwr. Co., to operate in Garrett; the Summit Township El. Lt., Ht. & Pwr. Co., to operate in Summit, and the Black Township El. Lt., Ht. & Pwr. Co., to operate in Black Township. The incorporators are: J. Wilmoth, Fred L. Wilmot and Barney D. Wilmoth.

IRWIN, PA.—The Penn El. Co. is contemplating rebuilding its plant in Irwin, recently destroyed by fire.

NEW SEWICKLEY, PA. (not a post office).—Application has been filed with the State Department for a charter for the New Sewickley Lt. Co. by A. W. Stevenson, A. W. Robertson, J. R. McNary, L. F. Kane and E. W. Washabaugh. The company proposes to supply electricity for lamps, heater and motors in the township of New Sewickley.

PAOLI, PA.—Revised plans have been completed and estimates will soon be asked by the Pennsylvania R. R. Co. for the construction of a power house in Paoli, in connection with equipping its main line for electrical operation. The building will be one story high, 80 ft. by 180 ft.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 11 for mechanical equipment (except elevator) for the experiment station, United States Bureau of Mines, Pittsburgh, Pa., in accordance with drawings and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

PITTSBURGH, PA.—Contracts have recently been approved by the Public Service Commission as follows: Barnesboro-Spangler El. Co., of Barnesboro, and the borough of Spangler; Duquesne Lt. Co., of Pittsburgh, and borough of Carrick; Duquesne Lt. Co. and the borough of Roslyn; Citizens' Lt., Ht. & Pwr Co. and the borough of Ferndale; Citizens' Lt., Ht. & Pwr. Co. and the borough of Franklin, and the Boswell El. Co. and the borough of Boswell. All the above contracts call for the installation of street-lighting system in the towns named.

SINKING SPRING, PA.—Extensive improvements are contemplated by the Sinking Spring El. Lt., Ht. & Pwr. Co. in the near future, which will include the installation of a new 300-kw generating unit. The company is erecting a transmission line to East Wyomissing and additional lamps are being erected in the borough of Shillington.

UNION DEPOSIT, PA.—Electricity for operating the proposed electric-lighting system in Union Deposit will be supplied from the power plant in Hershey owned by M. S. Hershey.

YOUNGSVILLE, PA.—Surveys are now being made for the construction of an electric railway to connect Youngsville and Sugar Grove, Pa., a distance of 9 miles. Right-of-way for the proposed road, it is said, has been secured. Electricity for operating the railway will be procured from Niagara Falls.

JERSEY CITY, N. J.—An improvement association has been organized by residents of West Side Avenue with a view of securing a better street-lighting system for that thoroughfare.

BALTIMORE, MD.—Plans are being considered by the superintendent of lamps and lighting for the installation of 50 additional lamps on Carey Street, between Pratt Street and North Avenue.

FREDERICK, MD.—Investigations are being made by the Board of Aldermen relative to rebuilding the street-lighting system. A new generator may be installed.

MOUNT AIRY, MD.—Arrangements are being made by the Mount Airy Ice & El. Co. for the installation of an electric-lighting plant in connection with its ice factory. The equipment will consist of a 50-hp or 60-hp steam engine, a 30-kw or 35-kw alternating-current generator, switchboard equipment, a 5-kw transformer and a 4-kva street regulator, 3 miles of pole line and 60 incandescent lamps of 60 cp. Contract for the work has not yet been awarded. C. C. Riddlemoser is manager.

FAIRMONT, W. VA.—Bids will be received by the State Board of Control, Charleston, until March 15 for construction, including heating, plumbing and electrical work, of the main building (two-story and basement, 66½ ft. by 265 ft.) of the Fairmont State Normal School, Fairmont, according to plans and specifications prepared by Paul A. Davis, 3d, architect, Presser Building, Philadelphia, Pa. Plans and specifications may be obtained at the office of the State Board of Control, Charleston.

FARMINGTON, W. VA.—The Board of Trade is considering the installation of an electric-light plant, water-works and sewerage system. Howard Coleman is secretary.

WHEELING, W. VA.—Extensive improvements are contemplated by the West Virginia Trac. & El. Co. during this year, which will include the extension of its lines in Monongalia County and enlarging its power plant in Morgantown.

GRUNDY, VA.—The installation of an electric-lighting plant in Grundy is under consideration. Harry M. Johnson, of Grundy, is interested in the project.

WASHINGTON, D.C.—The Potomac El. Pwr. Co. has applied to the Public Utilities Commission for permission to issue $495,000 in bonds, the proceeds to be used to pay for improvements already made and for work contemplated this year. Present plans provide for an expenditure of about $332,000.

WASHINGTON, D. C.—Bids will be received at the office of the chief of ordinance, War Department, Washington, D. C., until Feb. 23 for furnishing 336 firing magnets, type G-A. Bids must be submitted on lots of 100, 200, 300 and 336. For further information address the chief of ordinance.

North Central

BOYNE CITY, MICH.—The Michigan Tanning & Extract Co., of Boyne City, is making improvements to its power plant, including the installation of a new engine, generator, switchboard and condenser and relaying all pipes.

CLARE, MICH.—The purchase of what is known as the dam property, now owned by John O'Keefe, of Saginaw, will be recommended by Mayor W. L. Adams and

City Engineer White to the City Council to supply power for a municipal electric-light plant. The Consol. Lt. & Pwr. Co., of Mount Pleasant, furnishes electrical and street-lighting service for the city.

HOLLAND, MICH.—A movement has been started by the local business men to raise funds for the proposed ornamental street-lighting system. The cost is estimated at about $13,000.

MARQUETTE, MICH.—The construction of a new power house and penstock will be recommended to the City Council by Charles Retallic, superintendent of the municipal electric light and power plant.

MARQUETTE, MICH.—The Township Council has granted the Chippewa Edison El. Co., of Sault Ste. Marie, a franchise to erect a transmission line through Marquette. This will enable the company to furnish electrical service in a district just south of Pickford.

WEST BRANCH, MICH. — The local electric-light plant has been purchased by F. E. Hatch, of Detroit. The new owner, it is understood, will rebuild the system, at a cost of about $30,000, and establish a 24-hour service.

ALLIANCE, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 1 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Alliance, Ohio. Drawings and specifications may be obtained from the above office or from the custodian of site at Alliance.

ALPHA, OHIO.—The County Commissioners have granted the Dayton Pwr. & Lt. Co., of Dayton, a franchise to extend its transmission line from its main line at Alpha to supply electricity in Alpha and surrounding district.

ASHTABULA, OHIO.—Work is progressing on the proposed street-car line between Ashtabula and Harmon Park. The railway will be about 7 miles long and will cost about $150,000. The cars will be operated by storage batteries. A power plant for charging the batteries will be erected.

BUCYRUS, OHIO.—The Public Utilities Commission has granted the Bucyrus Lt. & Pwr. Co. permission to issue $58,000 in bonds, the proceeds to be used for extensions and improvements to its system. The company, it is understood, intends to purchase a new steam plant to replace the old equipment and the gasoline engines now in use, to cost about $41,000. The remaining $17,000 will be used for general improvements. Orders for machinery have been placed.

BUTLER, OHIO.—Plans are being considered for improvements to the municipal electric-lighting plant, for which bonds to the amount of $4,000 have been issued. The purchase of a gas engine is also under consideration.

CHILLICOTHE, OHIO.—The Mead Pulp & Paper Co. is reported to be contemplating enlarging its pulp mill and power plant at a cost of about $100,000.

DAYTON, OHIO.—The Dayton Pwr. & Lt. Co. has purchased a tract of 32 acres on the Springboro Pike, south of the city, on which it expects to erect a large power plant in the near future.

FRANKLIN, OHIO—The installation of a municipal electric-lighting plant is reported to be under consideration. The contract for street lighting with the Franklin El. Lt. Co. expires next August.

NORWALK, OHIO.—Bids, it is reported, are being received by the city of Norwalk for a $100,000 bond issue, the proceeds to be used for the construction of a municipal electric-lighting plant.

TOLEDO, OHIO.—Petitions are being circulated by the Chamber of Commerce asking the City Council to install an ornamental lighting system in the business district.

WORTHINGTON, OHIO.—The Village Council is considering plans for lighting the village by electricity. The Columbus Ry., Lt. & Pwr. Co., of Columbus, is considering extending its transmission line from near Minerva Park, across to Chaseland, to supply energy for the pottery, and from there to Worthington.

COVINGTON, KY.—The Union Lt., Ht. & Pwr. Co. has submitted a proposal to the City Council offering to replace the present street-lighting system with nitrogen-filled lamps, at a cost of about $30,000, the expense to be borne by the company.

FORT THOMAS, KY.—Plans are being considered by local business men to establish an electric-lighting plant in Fort Thomas for the purpose of supplying electrical service to the residents of the Highlands.

HAZARD, KY.—The local electric-light plant, it is reported, has been purchased by B. P. Wooten and others. The new owners, it is understood, will install new equipment.

IRVINE, KY.—An electric franchise, it is reported, will soon be offered for sale by the Board of Trustees.

LEXINGTON, KY.—The Lexington Utilities Co. is contemplating the installation of an ornamental street-lighting system, consisting of 192 300-watt, type C Mazda lamps. J. P. Pope is electrical engineer.

ANDERSON, IND.—Within the next 12 months the Board of Public Works expects to purchase one 3000-kw generator and one 500-hp boiler and new switchboard; also material for distribution system and lighting system, including transformers, poles, lightning arresters, distribution cable and wire, meters, lamps, etc., to cost approximately $12,000. L. A. Stephens is secretary.

CANNELTON, IND.—The managers of the municipal electric-light plant are erecting 2 miles of three-phase, 2300-volt transmission line to supply electricity to operate machinery in a small coal mine. W. P. Martin is superintendent.

CHALMERS, IND.—A proposal to install an electric-lighting plant in Chalmers, to cost from $5,000 to $7,000, has been submitted by Messrs. Thayer & Cheadle, of Indianapolis.

EVANSVILLE, IND.—The Evansville Pub. Ser. Co. has purchased for delivery April 1 a 5000-kw Westinghouse turbine and condenser and has just placed an order for two 500-hp water-tube boilers. The company is now building an extension to its power house. The company is now installing a new street-lighting system, consisting of from 1700 to 1800 nitrogen-filled lamps, replacing some 600 6.6-amp lamps and 700 gas lamps. The plans provide for about 350 lamps of 1000 cp, 350 lamps of 600 cp, and 1000 lamps of 250 cp. A. C. Blinn is general manager.

JASONVILLE, IND.—Within the next few months Flem Van Meter, receiver of the Jasonville Wtr. & Lt. Co., expects to purchase a generating unit of about 185 kva, 2200 volts or 2300 volts, three-phase, 60 cycles (directly connected) without switchboard or instruments.

KNIGHTSTOWN, IND.—Within the next 12 months the managers of the municipal electric light and water plant expect to expend about $200 for lamps and also to purchase a few electrical appliances and devices. M. Hiatt is superintendent.

LA GRANGE, IND.—The La Grange El. Lt. Co. expects to purchase within the next six months two 150-hp boilers, one 250-hp engine, a 150-kva generator with exciters, switchboards, etc., also 65 ornamental lamp-posts, and to replace the present arc lamps with nitrogen tungsten lamps. Within the next 12 months the company also expects to purchase quite a large amount of all kinds of heating appliances. C. J. Avis is manager.

MADISON, IND.—The Madison Lt. & Ry. Co. will install within the next two months a 500-kw General Electric high-pressure turbine. Alberger condenser and auxiliaries, which have already been purchased. The company has also purchased a General Electric generator and exciter, switchboard, motor-generator and exciter. M. F. Tennis is president.

ADDIEVILLE, ILL.—The Nashville El. Lt. Co., of Nashville, has been granted a franchise to supply electricity in Addieville for a period of 20 years; also a contract (consisting of 20 lamps of 100 cp) for lighting the streets of the village. The company expects to extend its transmission line from Nashville to Addieville in the spring. K. A. Steinhauser is secretary and manager.

BLOOMINGTON, ILL.—Within the next 12 months the city of Bloomington expects to purchase materials for the municipal distribution and lighting system, involving an expenditure of $10,000, which will include transformers, poles, lightning arresters, insulators, distibution cable and wire, incandescent lamps, etc. C. C. Williams is electrician.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 700-910 South Michigan Avenue, Chicago, until Feb. 18 for pole erection and line construction in the streets of the city of Chicago. For details see proposal columns.

ELBURN, ILL.—Within the next six months the town of Elburn expects to purchase a new engine for the municipal electric-lighting plant, but as yet is undecided whether to install steam or oil. The plant at present is driven by a gas engine. A. H. Sharp is superintendent.

EMDEN, ILL.—The Emden Wtr., Lt. & Pwr. Co. has been granted permission by the Illinois Public Utilities Commission to issue $2,400 in capital stock.

GRANVILLE, ILL.—Within the next three months Sidney Whitaker, owner of the local electric-light plant, expects to purchase one 75-kw, three-phase, 2300-volt generator. A 120-hp Chuse non-releasing Corliss valve engine has just been installed in the plant.

HAVANA, ILL.—The Central Illinois Pub. Ser. Co., of Havana, is contemplating the erection of a substation within the next 12 months to increase the generating capacity of its plant; also the purchase of a 33,000-volt transformer. R. A. McMahon is local superintendent.

HOMER, ILL.—The Homer El. Lt. & Pwr. Co. expects to purchase within the next three months a 75-kw, three-phase, 1100-volt generator. U. S. Thompson is owner and manager.

MACKINAW, ILL.—Within the next 12 months the Electric Lt. Co. of Mackinaw expects to purchase material for distribution and lighting systems, including wire, meters, incandescent lamps, posts, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. F. E. Hart is general manager.

MATTOON, ILL.—Within the next three months the Central Ill. Pub. Ser. Co., of Mattoon, expects to erect a transmission line from Astoria to Bushnell, together with a branch line from Table Grove to Ipava; also to make within the next two months necessary changes to the distribution system in Ipava to provide for a 24-hour service, utilizing alternating current from the transmission line. Henry M. Brooks is assistant auditor.

PARIS, ILL.—Plans are being considered for the installation of six lamp clusters on each side of the square. Roscoe A. Coffman is interested in the project.

PITTSFIELD, ILL.—The Women's Club of Pittsfield will ask for bids for the installation of 30 ornamental posts, carrying three-lamp clusters, within the next 30 days. J. A. Hayworth, of Jacksonville, Ill., is engineer. E. B. Doocy is local superintendent of the Central Illinois Pub. Ser. Co., which furnishes electrical service in Pittsfield.

ST. CHARLES, ILL.—Bids will be received by the State Board of Administration, Springfield, until Feb. 23 for electric wiring in the amusement hall at the St. Charles School for Boys at St. Charles. Plans are on file at the office of J. B. Dinelka, state architect, 29 South La Salle Street, Chicago.

WENONA, ILL.—Within the next six months the Wenona Lt. & Pwr. Co. expects to replace the 35 street arc lamps now in use with type C incandescent street-lighting fixtures. C. J. Kays is president.

MEDFORD, WIS.—The Medford El. Lt. & Htg. Co. is reported to be contemplating the construction of a power house and the purchase of additional equipment. The company proposes to furnish a 24-hour service when improvements are completed.

KENYON, MINN.—On Feb. 16 the school board of district No. 91 will meet to look over plans and consider estimates for construction of new school building, the cost not to exceed $53,000, exclusive of the old building, which must be razed by the contractor and the material used by him, and to include heating, plumbing and electrical work and ventilating system. J. C. E. Holmen is city clerk.

MINNEAPOLIS, MINN. — The City Council has adopted a resolution asking the State Legislature for authority to sell $100,000 in bonds, the proceeds to be used to double the output of the electric lighting and heating plant and to enlarge the crematory. About $75,000 will be required for the heating and lighting plant. It is proposed to enlarge the plant to enable it to generate sufficient electricity to maintain 200 street lamps.

ST. PAUL, MINN.—The report of Joseph Macauley, superintendent of the police and fire-alarm system, submitted to the City Council, recommends the installation of motor-generators to take the place of batteries in the police-alarm system. He also requests that 13 miles of wire be installed and that reliable recording systems be purchased to replace those now in use.

BUFFALO CENTER, IA.—The City Council is considering the question of installing a municipal electric-lighting system, to cost about $10,000.

CLARKSVILLE, IA.—The Cedar Valley Pwr. Co., of Charles City, is contemplating the erection of a transmission line from Charles City to Clarksville and establishing a 24-hour service during 1915. H. H. Dodd is secretary of the company, and A. D. Van Meter is local manager.

DECORAH, IA.—The Interstate Pwr. Co., Upper Iowa Pwr. Co. division, is extending its transmission lines to Ossian,

Ia., where energy will be sold in bulk to the local company. G. W. Welch is electrical engineer.

GRUNDY CENTER, IA.—Plans are being considered by J. B. Calderwood, owner of the local electric-light plant, to extend the electric-lighting system to the towns of Holland and Wellsburg. The cost of extension is estimated at about $5,000.

IRWIN, IA.—At an election held recently the proposal to issue $6,000 in bonds for the installation of an electric-lighting system was carried. Energy to operate the system will be obtained from the Manila plant.

MALLARD, IA.—The installation of a municipal electric-lighting system in Mallard, to cost about $8,000, is under consideration.

NASHUA, IA.—The Cedar Valley Pwr. Co., of Charles City, expects to erect a transmission line from Charles City to Nashua and to establish a day service during 1915. H. H. Dodd is secretary of the company, and C. I. Snyder is local manager.

OAKLAND, IA.—The transmission line now being erected from Oakland to Emerson will be completed within a few weeks. This line will connect both towns, which will receive electrical service from the Red Oak central station. Energy will be delivered at 33,000 volts. D. D. Dermyer is chief engineer.

YORKTOWN, IA.—The installation of an electric-lighting system in Yorktown is under consideration by the Town Council. Negotiations are under way to secure the service from the Clarinda plant.

DEEPWATER, MO.—Work will soon begin on the construction of the municipal electric-lighting system, bonds for which were recently voted.

HALE, MO.—Plans are being prepared for the installation of a municipal electric-light plant, to cost about $11,000. An election will soon be called to vote on the proposal to issue bonds for same. W. B. Rollins & Co., Midland Building, Kansas City, Mo., are engineers.

KANSAS CITY, MO.—The Kansas City El. Lt. Co. has applied to the Public Service Commission for permission to acquire the property and holdings of the Kansas City Htg. Co., at $987,000.

MARSHALL, MO.—A petition has been submitted to the City Council asking that an election be called to submit to the voters the proposal to issue $70,000 in bonds for the installation of a municipal electric-lighting plant.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, 315 City Hall, St. Louis, Mo., until Feb. 19 for furnishing two water-tube boilers with superheaters, fittings and appurtenances; also for six chain-grate stokers and coal-handling machinery. E. R. Kinsey is president of board.

GRAND FORKS, N. D.—Bids will be received by W. H. Alexander, city auditor, Grand Forks, until March 1, for laying underground wires and installation of lamp-posts, including labor and material, for the extension of the ornamental street-lighting system. J. J. Smith is city engineer.

ALCESTER, S. D.—A committee has been appointed by the Commercial Club to make investigations as to the cost of installing a municipal electric-lighting plant in Alcester.

ARMOUR, S. D.—Considerable work is contemplated by the Interstate Pwr. Co., South Dakota division, to its Armour plant, during the coming season, including the installation of a second Diesel engine unit, a second Muenzel gas-producer unit, new switchboard panels, and the erection of considerable new transmission line. G. W. Welch, of Decorah, Ia., is electrical engineer.

BRUCE, S. D.—The installation of a municipal electric-lighting plant and waterworks system in Bruce is under consideration.

GAYLORD, KAN.—Bids will be received at the office of W. S. Meadows, city clerk, Gaylord, until Feb. 17 for the construction of a municipal electric-light plant. Separate bids will be received as follows: (1) Internal-combustion engines, installed on foundations built under separate contract; bids will be received for one 50-hp engine and one 30-hp engine, the city reserving the right to accept one or both bids; (2) for one 37½-kw and one 25-kw, three-phase, 2300-volt alternator, constant-current transformer, switchboard and all station equipment; (3) for furnishing all material for transmission lines; (4) for furnishing material and labor for erection of foundations, generators and station equipment and transmission lines; (5) for furnishing material and erecting power house, cistern and cooling tower. Plans and specifications are on file with the city clerk, Gaylord, and at the office of George P. Taylor, Stockton, Kan. Copies of plans may be secured from the engineer upon payment of $3 per set.

GREENSBURG, KAN.—The City Council is contemplating improvements to the municipal electric-light plant and lighting system.

Southern States

NORLINA, N. C.—The city of Norlina will petition the State Legislature for authority to vote on the proposal to issue bonds for the installation of a municipal electric-lighting plant and water-works system.

WAYNESVILLE, N. C.—The Board of Aldermen has petitioned the State Legislature for authority to issue bonds, the proceeds to be used for the purchase of a hydroelectric power site, to install a power plant and to purchase watershed.

WAYCROSS, GA.—The Ware County Lt. & Pwr. Co., of Waycross, expects to purchase within the next 12 months miscellaneous electrical appliances, devices and supplies, aggregating about $2,000; material for distribution system and lighting system to meet ordinary requirements and extensions. R. E. Trexler is assistant treasurer.

WEST POINT, GA.—Within the next few months the managers of the municipal electric-lighting plant expect to purchase lightning arresters for the distribution lines. H. L. Hill is superintendent.

GREEN COVE SPRINGS, FLA.—A franchise, it is reported, has been granted to S. I. Talmadge and C. O. Lohmeir to construct and operate an electric-lighting plant in Green Cove Springs

CLARKESVILLE, TENN.—Steps have been taken to promote the project to establish an ornamental street-lighting system in the business district.

GLEASON, TENN.—The City Council is considering the question of submitting the proposal to issue $7,000 in bonds for the construction of a municipal electric-lighting plant to the voters.

SHELBYVILLE, TENN.—The local electric-lighting plant, owned by the Duck River Pwr. Co., it is reported, has been purchased by the Tennessee Pwr. Co., of Chattanooga. The new owner, it is understood, will make improvements to the service. Electricity for operating the system will be procured from the large plant on the Tennessee River.

DAUPHIN ISLAND, ALA.—Preparations are being made by the Tidewater Securities Corpn. for the development of Dauphin Island. The plans provide for the construction of an electric railway (9 miles long), the installation of an electric light and power plant, telephone system and extension to water-works. J. M. Dewberry, Van Antwerp Building, Mobile, Ala., is president of the company.

LINCOLN, ALA.—Plans are being considered by the Alabama Pwr. Co., of Birmingham, to establish an electric-lighting plant in Lincoln.

GRAVETTE, ARK.—The City Council is considering a proposal submitted by Mr. Bryant, of Ashdown, for the purchase of the municipal electric-lighting plant.

BRISTOW, OKLA.—Arrangements, it is reported, have been completed by P. N. House, who holds a franchise, to install an electric-lighting plant in Bristow during the coming summer.

POND CREEK, OKLA.—Plans are being considered for extensions to the municipal electric-light plant and water-works system, for which bonds were recently issued.

ABILENE, TEX.—Improvements, it is reported, are contemplated by the Abilene Gas & El. Co., involving an expenditure of about $150,000. The work will include a high-power turbine engine and the installation of ice vaults.

BROWNSVILLE, TEX.—The Water and Light Department has been authorized by the City Council to install an ornamental street-lighting system in the business district.

MARSHALL, TEX.—The Marshall El., Ice & Trac. Co., it is reported, is contemplating improvements to its electric and ice plants, involving an expenditure of about $75,000.

OZONA, TEX.—Improvements, it is reported, are being made to the local electric-light plant and water-works system. Frank F. Friend is interested in the company.

POLYTECHNIC, TEX.—A committee consisting of Mayor H. W. Lowe and F. M. Bransford, city attorney, has been appointed by the City Commissioners to investigate the proposal to establish a municiapl electric-lighting plant.

Pacific States

COLFAX, WASH.—Application has been made to the City Council by the Elberton Building & Pwr. Co. for a franchise to furnish electricity in Colfax for a period of 50 years. Charles N. Hinchcliff, representing the company, operates a large flour mill at Elberton, 13 miles from Colfax, and is owner of a power site in that town, where it is estimated that a maximum of 1500 hp can be developed. The proposed franchise provides that energy shall be furnished to both Colfax and Elberton.

WALLA WALLA, WASH.—A petition has been presented to the City Commissioners, signed by local business men, asking for the installation of cluster street-lighting system in the business district of the city.

BAR VIEW, ORE.—Arrangements are being made for the installation of an electric-street-lighting system in Bar View. J. R. Wheeler, of Bar View, is electrical engineer.

ST. JOHN, ORE.—The Western Cooperage Co., Northwest Building, Portland, has engaged R. G. Little, of the West Coast Engineering Co., of Portland, as electrical engineer, on the new plant which it is now erecting at St. John. Specifications have been drawn for motors, and proposals are now being received at the offices of the Western Cooperage Co. in Portland. The installation will consist of from 30 to 40 motors, aggregating about 1000 hp. The plant is designed for an ultimate installation of from 1800 hp to 2000 hp.

McARTHUR, CAL.—The Board of Supervisors has granted the petition of Roderick McArthur, acting for the John McArthur Land Co., of which he is manager, asking that an electric franchise be offered for sale. The company proposes to develop power from its drainage canals to supply electricity for its own use and for its tenants. The proposed franchise gives the company the privilege to serve the general public.

BOISE, IDAHO.—The Hayes Investment Co., recently incorporated with a capital stock of $100,000, is contemplating the construction of a power plant. B. E. Hyatt and Daniel Hayes, of Rock Island, Ill., are interested in the project.

HUNTINGTON, UTAH.—The Huntington Canal & Reservoir Co., it is reported, is contemplating the installation of a power plant.

PHOENIX, ARIZ.—Plans are being considered for installing an ornamental lighting system in the State Capitol Grounds. The plans provide for 16 standards.

PLENTYWOOD, MONT.—Improvements are being made to the Plentywood electric plant, situated at the coal mine, 3 miles from the city. New equipment will consist of two 125-hp boilers, one 100-hp steam engine, one 75-kw, three-phase, 60-cycle, 2300-volt generator, and switchboard equipment and transformers, aggregating 75 kw. Three miles of line will be required for the distribution system and 150 10-amp, single-phase, 60-cycle meters will be used. The Interstate El. Co., of Williston, N. D., has the contract. Sidney J. Dorothy, of Williston, N. D., is engineer in charge. George D. Sunderhauf is manager.

Canada

NEWMARKET, ONT.—A by-law will probably be submitted to the ratepayers in the near future authorizing the Council to enter into an agreement with the Toronto & York Radial Ry. Co. to supply energy for the municipal electric plant.

OTTAWA, ONT.—Tenders will be received by the secretary of the Board of Control, City Hall, Ottawa, until Feb. 18 for hand railing and lamp-posts for Billings Bridge. Plans and specifications may be obtained upon application to the city engineer's office. F. C. Askwith is acting engineer.

TICHBORNE, ONT.—Investigations are being made by Fream Brothers in regard to the construction of a hydroelectric plant on Eagle Creek, principally to supply electricity for their works there and also to light the village of Tichborne Junction, about 1 mile distant.

TORONTO, ONT.—Signed by-laws have been received by the Ontario Hydro-Electric Power Commission for the Toronto-Port Perry Hydro-radial line, covering 11 municipalities. This involves the erection of 94 miles of transmission line. Contracts have also been received by the commission for the following municipalities on the Eugenia Falls system: Chatsworth, Dundalk, Shelburne, Durham and Mount Forest; these are in addition to the con-

tracts already received from Eugenia, Flesherton and Owen Sound. The commission has awarded contracts amounting to $400,000 for equipment.

QUEBEC, QUE.—Arrangements have been made for reorganizing the Dorchester El. Co., of Quebec. A new company will be formed, the control of which will be vested in the Shawinigan Wtr. & Pwr. Co., which is preparing to enter the Quebec field. It will be called upon to erect 75 miles of transmission line, which will require special financing.

ROBERVAL, QUE.—Plans have been prepared by J. E. Thibault, of Bagotville, for the installation of an electric-lighting system in Roberval. It is proposed to develop a water-power about 3 miles from the town and equip the proposed plant to generate 600 hp.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEBRUARY 2, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,126,681. SIGNALING AND INDICATING DEVICE; J. J. Aylward, Brooklyn, N. Y. App. filed March 4, 1914. For secondary clocks, elevators, etc.

1,126,684. DIRECTION INDICATOR; H. D. Ball, J. I. Floyd and L. S. Carr, Beloit, Wis. App. filed May 18, 1914. Automobile rear signal.

1,126,701. SEMI-MECHANICAL TELEPHONE SYSTEM; A. M. Bullard, New York, N. Y. App. filed April 3, 1907. Automatic line-switching mechanism.

1,126,727. SELECTOR SWITCH; H. G. Dietl, Vienna, Austria-Hungary. App. filed April 11, 1913. Embodies a shaft with a plurality of brushes.

1,126,733. CABLE TERMINAL; H. W. Dunbar, Newark, N. J. App. filed Dec. 27, 1910. Of the open and pot-head type.

1,126,745. TELEGRAPHIC TYPE-PRINTING RECEIVER; A. Franke, Grunewald, and E. Ehrhardt, Berlin, Germany. App. filed Aug. 19, 1911. Perforated tape.

1,126,762. LIFTING-MAGNET CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed April 29, 1912. To cause lifting magnet to release and drop its load quickly.

1,116,775. CLOSED-CIRCUIT SIGNAL SYSTEM; E. M. Jones, Atlanta, Ga. App. filed April 8, 1908. For railways (forty-six claims).

1,126,776. ELECTRIC SIGNAL SYSTEM; E. N. Jones, Atlanta, Ga. App. filed July 13, 1908. Embodies contact plates on the track bed.

1,126,777. ELECTRIC SIGNAL SYSTEM; E. M. Jones, Atlanta, Ga. App. filed July 14, 1908. Operates cab signal and applies brakes.

1,126,778. AUTOMATIC SIGNALING AND TRAIN-STOPPING DEVICE; E. M. Jones, Atlanta, Ga. App. filed May 13, 1910. Semaphore type and cab signal.

1,126,788. ELECTRIC SWITCH; L. F. Kries, Baltimore, Md. App. filed Oct. 27, 1913. Combined switch and fuse box with protected contacts.

1,126,800. ARC-LAMP; G. M. Little, Pittsburgh, Pa. App. filed May 10, 1906. "Flaming" type with composition electrode above the metallic electrode.

1,126,803. TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, New Rochelle, N. Y. App. filed Oct. 6, 1908. Automatic switching mechanism.

1,126,804. POWER SYSTEM FOR AUTOMATIC SWITCHES; F. R. McBerty, Antwerp, Belgium. App. filed Aug. 21, 1913. Groups of switches driven from independent power shafts.

1,126,826. SYSTEM OF ELECTRICAL SIGNALING; E. G. Missbach, New York, N. Y. App. filed July 18, 1912. Has automatic means for temporarily increasing the operating current.

1,126,834. ELECTRIC SWITCH-LOCK; W. P. Neubert and W. E. Smith, Wilkinsburg, Pa. App. filed March 24, 1914. For control of "outlying" switches.

1,126,842. ELECTRICAL APPLIANCE; R. H. Olley, North Tonawanda, N. Y. App. filed Feb. 18, 1911. Snap-switch structure applied to panelboard.

1,126,877. VAPOR ALTERNATING-CURRENT RECTIFIER AND SIMILAR APPARATUS; B. Schaefer, Frankfort-on-the-Main, Germany. App. filed March 1, 1912. Control of the arc path between the mercury of cathode and anode.

1,126,935. ELECTRIC HEATER; C. M. Angell, Santa Barbara, Cal. App. filed May 11, 1914. Inclosed in a decorative pottery stand.

1,126,951. ELECTRIC SWITCH; P. D. Bucknum, Oklahoma, Okla. App. filed Jan. 30, 1914. For burglar alarms at doors, windows, etc.

1,126,952. SEMI-MECHANICAL TELEPHONE SYSTEM; A. M. Bullard, New York, N. Y. App. filed April 3, 1907. Complete system (one hundred and forty-three claims).

1,126,956. METHOD OF AND MEANS FOR EQUALIZING THE POTENTIALS OF GROUNDING POINTS; A. B. Clark, Brooklyn, N. Y. App. filed Oct. 29, 1913. Potential applied to ground connection at one station which will tend to neutralize the ground potential differences.

1,126,963. SEMI-AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Feb. 12, 1912. Particular system of selectors.

1,126,966. SENDING MECHANISM FOR ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed Aug. 26, 1904. Includes a typewriter and simultaneously operating code commutator.

1,126,985. PUSH-BUTTON SWITCH; A. W. Gray, Pittsburgh, Pa. App. filed April 20, 1912. Single-button type.

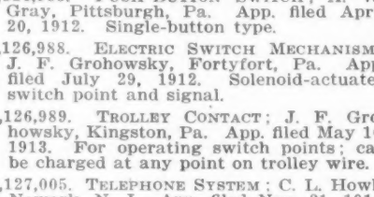
1,126,988. ELECTRIC SWITCH MECHANISM; J. F. Grohowsky, Fortyfort, Pa. App. filed July 29, 1912. Solenoid-actuated switch point and signal.

1,126,989. TROLLEY CONTACT; J. F. Grohowsky, Kingston, Pa. App. filed May 10, 1913. For operating switch points; can be charged at any point on trolley wire.

1,127,005. TELEPHONE SYSTEM; C. L. Howk, Newark, N. J. App. filed Nov. 21, 1913. For railway trains.

1,127,008. ELEVATOR SIGNAL SYSTEM; C. S. Johnson, Dallas, Tex. App. filed Aug. 6, 1912. Novel push-button and signal arrangement.

1,127,017. HIGH-FREQUENCY THERAPEUTICAL APPARATUS; F. M. and M. H. Kidder, New York, N. Y. App. filed Aug. 11, 1914. Constructed so that the cord can be wound lengthwise around the same.



1,127,103—Automobile Signal

1,127,021. INCUBATOR; R. Klett, New York, N. Y. App. filed June 12, 1914. For incubating bacteria; heating element uniformly incloses incubating chamber.

1,127,025. PROCESS FOR PRODUCING PERFORATED TUBULAR ELECTRODES FOR ACCUMULATORS; J. Krannichfeldt, Cologne-Niehl, Germany. App. filed Nov. 25, 1914. Paper covering for the perforations is detroyed by acid after the electrodes have been filled with active material.

1,127,042. MANUFACTURE OF HIGH-POTENTIAL PORCELAIN AND GLASS INSULATORS; F. M. Locke, Victor, N. Y. App. filed March 9, 1909. Glass base and boron compound fused therewith.

1,127,043. ELECTRIC-ARC EXTINGUISHER; F. M. Locke, Victor, N. Y. App. filed July 31, 1911. Employs explosive cartridge.

1,127,044. INSULATOR; F. M. Locke, Victor, N. Y. App. filed Mar. 9, 1914. Silica and boron compound.

1,127,050. IMPULSE-SENDING MECHANISM; F. R. McBerty, Antwerp, and A. H. Adams, Brussels, Belgium. App. filed Dec. 19, 1913. "Finger-wheel" construction.

1,127,083. TELAUTOGRAPHIC APPARATUS; H. W. O'Neill, Brooklyn, N. Y. App. filed April 22, 1912. Vibratory condition of current on the tracer lines.

1,127,084. WATER-LEVEL INDICATOR; J. J. Ogilvie and F. F. Dier, Ottawa, Ontario, Canada. App. filed April 10, 1914. Improved construction of water column.

1,127,088. PANELBOARD RECEPTACLE; C. D. Platt, Bridgeport, Conn. App. filed July 25, 1913. Screw socket constructed for attachment to panelboard.

1,127,103. AUTOMOBILE SIGNAL; E. Soule, New York, N. Y. App. filed Aug. 12, 1914. Rear signal with audible alarm.

1,127,106. MULTIPLE-FUSE PLUG; E. Stranszky, Philadelphia, Pa. App. filed July 7, 1914. Fuse elements inserted in circuit by rotating the head of the plug.

1,127,119. OIL SWITCH; H. L. Van Vlakenburg, Norwood, Ohio. App. filed Aug. 21, 1905. Vertically movable plunger type; high voltage.

1,127,158. DYNAMO-ELECTRIC MACHINE; V. G. Apple, Dayton, Ohio. App. filed April 6, 1914. Brush-holder construction for motor generator.

1,127,161. HEAD BAND FOR TELEPHONE RECEIVERS; N. Baldwin, Mill Creek, Utah. App. filed Oct. 18, 1913. Automatically adjustable to head.

1,127,178. RECORDING LOCK; H. W. Brown, Chicago, Ill. App. filed Jan. 24, 1910. Keys held by different persons establish different contacts.

1,127,185. CONTROLLING SYSTEM; H. W. Cheney, Norwood, Ohio. App. April 16, 1906. For motor driving available load.

1,127,193. ELECTRICAL SIGNALING APPARATUS; W. T. Craft, Denver, Col. App. filed May 9, 1913. Notifies residence of the approach of a trolley car.

1,127,197. IGNITION APPARATUS FOR AUTOMOBILES AND THE LIKE; E. H. Cunningham, New York, N. Y. App. filed July 13, 1912. Combined switch, induction coil and container.

1,127,206. SPRING PROTECTOR FOR TROLLEY RETRIEVERS AND CATCHERS; M. O. Dolson, Los Angeles, Cal. App. filed Nov. 19, 1913. If trolley rope breaks, the spring is prevented from wholly unwinding.

1,127,217. ELECTRIC-RAILWAY SYSTEM; O. E. Falch, Jr., Mill Valley, Cal. App. filed Feb. 26, 1909. Collector makes contact with plates on roadway or overhead.

1,127,232. GATE VALVE SIGNAL; L. A. Grimes, New York, N. Y. App. filed Oct. 22, 1913. Can be applied to standard gate valves.

1,127,263. STARTING DEVICE FOR ALTERNATING AND THREE-PHASE CURRENT MOTORS; M. Kallmann (deceased), Berlin, Germany. App. filed March 25, 1909. Substantially constant resistance is included in the closed rotor circuit when the current is reversed.

1,127,280. RESISTANCE ELEMENT AND PROCESS OF MAKING SAME; R. H. Read, Washington, D. C. App. filed June 5, 1914. Resistance wire surrounded by asbestos inclosed within a seamless metal tube.

1,127,281. RESISTANCE WIRE FOR ELECTRIC HEATERS; R. H. Reed, Washington, D. C. App. filed July 19, 1910. High-resistance core wire is surrounded by insulating powder within a seamless metal shell.

1,127,290. VARIABLE-FREQUENCY COMMUTATOR MACHINE; A. Scherbius, Baden, Switzerland. App. filed April 3, 1911. Independent regulation of frequency and voltage without altering the number of turns of the exciting windings.

1,127,326. WEATHERPROOF CAP AND SHELL FOR INCANDESCENT ELECTRIC LAMPS; C. A. Vetter, Pittsburgh, Pa. App. filed July 31, 1913. Porcelain cap and shell connected by screw threads.

1,127,360. PREVENTION OF PITTING AND CORROSION IN STEAM BOILERS, HEATING BOILERS FOR HOT-WATER CIRCULATION, CALORIFIERS AND THE LIKE; C. Haythorpe, Kennington, London, Eng. App. filed Nov. 15, 1914. Zinc and carbon plates.

1,127,364. FURNACE HOIST; D. Larson, Berlin, Germany. App. filed March 21, 1913. Automatic push-button or remote-control system for a skip hoist.

1,127,367. CONTACT OILER; P. G. MacGregor, New York, N. Y. App. filed Dec. 13, 1912. For street-car controllers.

1,127,368. INTERFERENCE PREVENTER; T. B. Miller, Seattle, Wash. App. filed Jan. 6, 1913. Picks up weaker waves from a distant point without interference by stronger waves from a nearby source.

1,127,371. APPARATUS FOR AMPLIFYING OR DETECTING ELECTRICAL VARIATIONS; G. W. Pierce, Cambridge, Mass. App. filed March 11, 1914. Evacuated tube made to recover its normal conductivity quickly.

1,127,373. ELECTRIC HEATER; R. H. Read, Schenectady, N. Y. App. filed March 23, 1909. Flattened tubular metal shell and inner wire insulated therefrom by closely packed mineral powder.

1,127,374. ELECTRIC HEATER; R. H. Read, Washington, D. C. App. filed Jan. 3, 1914. Connections affording perfect freedom of expansion of the heater wires.

1,127,379. ELECTRIC SWITCH; C. A. Bates, Bridgeport, Conn. App. filed Dec. 30, 1913. Push-button type; makes various connections between the two incoming and the two outgoing circuit contacts.